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## ABSTRACT

Title of Thesis/Dissertation: Prospective Analysis of Risk Factors Related to Depression and Post Traumatic Stress Disorder in Deployed United States Navy Personnel

Jeremiah D. Ford, Doctor of Philosophy, 2011

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United States Navy personnel have deployed in support of Operations Enduring Freedom and Iraqi Freedom more than any other past conflicts. This study assessed effects of deployment risk factors (i.e., combat exposure, prior deployments, component type, immediate risk for post traumatic stress and/or depression, and pre-deployment mental health care) on Navy personnel's risk for depression and post traumatic stress disorder 3 to 6 months post-deployment. Post-deployment ( $n = 1,052$ ) and full deployment ( $n = 687$ ) samples of U.S. Navy personnel gathered from the Armed Forces Health Surveillance Activity (AFHSA) were used in this study.

Personnel exposed to combat were at greater risk for post traumatic stress disorder ( $OR = 3.13$ ,  $95\% CI = 1.92-5.13$ ). No association was found between combat exposure and risk for depression ( $OR = 1.15$ ,  $95\% CI = 0.64-2.10$ ). Also no associations were found between prior deployments and risk for depression ( $OR = 1.11$ ,  $95\% CI = 0.63-1.94$ ) or post traumatic stress disorder ( $OR = 1.04$ ,  $95\% CI = 0.64-1.72$ ). Reserve personnel were at twice the risk for depression ( $OR = 2.05$ ,  $95\% CI = 1.15-3.65$ ) and 3.5 times the risk for post traumatic stress disorder ( $OR = 3.50$ ,  $95\% CI = 2.12-5.78$ ). Personnel with

immediate post-deployment depressive symptoms were at greater risk for depression 3 to 6 months post-deployment ( $OR = 6.94$ ,  $95\% CI = 3.75-12.84$ ) as well as at greater risk for post traumatic stress disorder 3 to 6 months following deployment ( $OR = 1.98$ ,  $95\% CI = 1.05-3.75$ ). Personnel with immediate post-deployment traumatic stress symptoms were at greater risk for depression 3 to 6 months following deployment ( $OR = 3.21$ ,  $95\% CI = 1.45-7.13$ ) as well as at greater risk for post traumatic stress disorder 3 to 6 months following deployment ( $OR = 6.68$ ,  $95\% CI = 3.40-13.13$ ). Finally, no association was found between pre-deployment mental health care and risk for depression ( $OR = 2.48$ ,  $95\% CI = 0.56-10.96$ ) or post traumatic stress disorder ( $OR = 3.15$ ,  $95\% CI = 0.82-12.18$ ).

This study provides initial evidence on the prospective effects of component type, immediate post-deployment depressive and traumatic stress symptoms, and pre-deployment mental health care on Navy personnel's risk for depression and post traumatic stress disorder 3 to 6 months following deployment. Furthermore, it adds to the moderate empirical support on the effects of combat exposure and prior deployments on Navy personnel's risk for depression and post traumatic stress disorder.

PROSPECTIVE ANALYSIS OF RISK FACTORS RELATED TO  
DEPRESSION AND POST TRAUMATIC STRESS DISORDER  
IN DEPLOYED UNITED STATES NAVY PERSONNEL

by

Jeremiah D. Ford, M.S.

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of the Uniformed Services University of the Health Sciences  
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## Dedication

This work is dedicated to my three children, Haley, Logan, and Harper, for their patience and understanding. After many years of school and many hours of writing, you guys make me look forward to each new day. I love coming home to your happy faces at the end of the day. You guys are the best!

And to Sarah, wife and best friend, I dedicate this work. You are my biggest supporter; you keep me grounded in reality while, at the same time, giving me the courage to chase my dreams. A simple thank you could never do justice to the gifts that you have brought into my life, but I will try anyway...Thank you.

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## Prospective Analysis of Risk Factors Related to Depression and Post Traumatic Stress Disorder in Deployed United States Navy Personnel

As of October 2007, roughly 1.6 million U.S. military personnel had deployed in support of Operations Enduring Freedom (OEF) and Iraqi Freedom (OIF) in Afghanistan and Iraq (Jaycox & Tanielian, 2008). Roughly 1.2 million of those personnel were active duty forces; whereas, around 450,000 of those personnel were reserve forces (Office of the Under Secretary of Defense, 2007). The number of deployments that U.S. military personnel have faced during OEF/OIF combat operations is the highest seen since the U.S. military became an all-volunteer force (Belasco, 2007; Bruner, 2006). In addition to an increased number of deployments, military personnel have experienced longer deployments and shorter times stateside prior to redeployment (Hosek, Kavanagh, & Miller, 2006). Military personnel who have deployed in support of OEF/OIF show higher rates of post traumatic stress disorder (PTSD) and depression (MDD) than have been seen in the U.S. population in general (Jaycox & Tanielian, 2008). In the extensive meta-analysis of research on mental health during OEF/OIF, Jaycox and Tanielian (2008) found that most of the research surrounding post-deployment PTSD and depression has been conducted using active duty personnel in the U.S. Army and U.S. Marine Corps, while the U.S. Navy has been the focus of less research.

Because of advances in military medicine and improvements in armor the number of casualties from OEF/OIF has been lower than in past conflicts (i.e., Vietnam); however, there are still a significant number of military personnel who are dealing with mental health problems as a result of these current conflicts

(Ward, 2006). According to a review of records in the Medical Board Online Tri-Service Tracking (MEDBOLTT) system, mental health conditions have been classified as the third most common reason for disability discharge from military service between February 2005 and February 2006, accounting for 12% of all disability discharges (Krahl & Litow, 2009). In active duty U.S. Navy personnel, mental health conditions remain a top reason for medical discharge, second only to orthopedic injuries (Marietta, Bohnker, Manos, & Sack, 2005). These findings illustrate the importance of studying PTSD and other forms of combat/operational stress that occur in OEF/OIF operations.

Much of the increase in deployment related operational tempo has been seen in U.S. Army and Marine Corps; however, there have been significant changes in deployment patterns in the U.S. Navy as well (Perry, 2006; Shen et al., 2009). Since the beginning of OEF/OIF combat operations, Navy aircraft carrier battle groups have deployed for an average of 7 to 10 months, compared with previous deployments that lasted 6 months (McNulty, 2005). Furthermore, as the OEF/OIF campaigns have persisted, more and more U.S. Navy personnel have been deployed in support of ground operations in these campaigns (Shen et al., 2009). Navy deployments represent around 19% of all active duty military deployments in support of OEF/OIF which is second only to U.S. Army (approx. 52% of all deployment) and exceeds the number of troop deployments in both the U.S. Marine Corps (i.e., 15%) and U.S. Air Force (i.e., 15%) (DMDC, 2008).

### *Role of the Reserves in U.S. Navy*

The United States Navy is composed of two components: active duty and reserve. The active component of the U.S. Navy includes service members who serve in a full-time, active duty status (DoD, 2008). The reserve component of the U.S. Navy includes service members who serve in a part-time, reserve status for a minimum of one weekend per month and two weeks of training per year (U.S. Navy Reserve, 2009). The Navy Reserves have served the United States in all major conflicts since World War I. In the early 1900's, Secretary of the Navy Josephus Daniels and Assistant Secretary of the Navy Franklin D. Roosevelt, campaigned for Congress to fund a Navy Reserve Force. In August of 1916, the Navy Reserve Force was formally organized with the first reservists flying biplanes searching for German U-boats. Two years into World War II, nearly all members of the Navy Reserve were serving on active duty. In the 1990s, over 21,000 Navy Reservists served in support of Operations Desert Shield and Desert Storm (U.S. Navy Reserve, 2009). As of October 2007 around 27,000 Navy reservists (i.e., 9% of Navy Reserve) had been deployed in support of OEF/OIF combat operations (Jaycox & Tanielian, 2008). There are over 6,500 Navy Reserve personnel currently mobilized in support of OEF/OIF and other operations around the globe (U.S. Navy Reserve, 2010).

### *Mental Health in Past U.S. Conflicts*

Since the American Civil War medical professionals have recognized the impact of mental health problems on the welfare of U.S. Soldiers. Records from the Union Army identified 2,410 cases of insanity among Union Soldiers and

5,213 cases of “nostalgia” (Blazer, 2005). The cases of “nostalgia” consisted of symptoms such as constricted affect, social isolation, and disciplinary problems (Blazer, 2005). During World War I, mental health professionals treated Soldiers for what these professionals termed “effort syndrome”, which consisted of shortness of breath, headache, fatigue, concentration difficulties, and nightmares (Blazer, 2005). It wasn’t until 1980 that PTSD was coded as a diagnosis in the Diagnostic and Statistical Manual of Mental Disorders (DSM-III) as well as accepted as a diagnosis by Veterans Affairs offices (Parrish, 2001). Prior versions of the DSM had diagnoses ‘similar’ to PTSD such as “stress response syndrome”, from original DSM in 1952, and “situational disorders”, from DSM-II in 1968 (Parrish, 2001). Studies of Vietnam War veterans have shown rates of PTSD around 30% and roughly 45% of those Soldiers with PTSD also had depression (Kulka et al., 1990). In a study of Gulf War veterans, rates of PTSD two years post-conflict were around 8% (Wolfe et al., 1999). Looking across a 150 year history of armed conflict, we see that many of the symptoms observed during the Civil War, World Wars I and II, Vietnam, and Persian Gulf War are similar and include anxiety/agitation, sleep disturbances, fatigue, and problems with concentration (Blazer, 2005). Although the technology of war has advanced through the century, the human response to war remains similar.

#### *Prevalence of PTSD/MDD in the United States*

Several epidemiological studies have been conducted on the prevalence of post traumatic stress disorder (PTSD) and major depression in the U.S. population in the last five years (O’Donnell, Creamer, & Pattison, 2004; Karlin,

Duffy, & Gleaves, 2008; Kessler et al., 2005). O'Donnell and colleagues (2004) report 12-month prevalence rates of 4% for PTSD and 6% for major depression. Karlin and colleagues (2008) released findings showing 12-month prevalence rates of 3.1% for PTSD and 5.9% for major depression. Kessler and colleagues (2005) showed 12-month prevalence rates of 3.5% for PTSD and 6.7% for major depression. This research on U.S. adults was used as a comparison to prevalence rates of PTSD and major depression found in studies on U.S. military samples.

#### *Prevalence of PTSD/MDD in U.S. Military*

Recent prevalence data on PTSD and major depression in the U.S. military was gathered via studies of military personnel who served in OEF/OIF combat operations (Hoge et al., 2004; Hoge et al., 2006; Schell & Marshall, 2008; Leardmann et al., 2009; Milliken et al., 2007; Seal et al., 2007). Hoge and colleagues (2004) assessed Soldiers and Marines for mental health 3 to 4 months after their deployment in support of OEF/OIF. These researchers found that 18% post-OIF Soldiers assessed met criteria for PTSD and 15% met criteria for major depression. This same study also looked at post-OEF Soldiers and discovered that 11.5% met criteria for PTSD and 14% met criteria for major depression. In a later study of post-OEF/OIF deployment mental health disorder rates, but using different outcome measures, Hoge and colleagues (2006) showed rates of PTSD of around 10% for Soldiers and Marines returning from Iraq, 5% for Soldiers and Marines returning from Afghanistan, and 2% for Soldiers and Marines returning from other deployments. In terms of major

depression, this study found the following rates: 4.5% for Soldiers and Marines returning from Iraq, 2.5% for those returning from Afghanistan, and 1.5% for those returning from other deployments around the globe. It is possible that differences in percentages of PTSD and depression between Hoge and colleagues (2004) and Hoge and colleagues (2006) were because of methodological differences between the two studies. Hoge and colleagues (2004) used the 17-item National Center for PTSD checklist to assess for PTSD; whereas, Hoge and colleagues (2006) used the Primary Care 4-item PTSD Screen (PC-PTSD). Furthermore, Hoge and colleagues (2004) used the PRIME-MD screening to assess for depression; whereas, Hoge and colleagues (2006) used the 2-item Patient Health Questionnaire for depression.

In a study assessing mental health of 1,965 military personnel who had deployed in support of OEF/OIF, Schell and Marshall (2008) report that 275 personnel (i.e., 14%) screened positive for PTSD and another 275 personnel (i.e., 14%) screened positive for major depression. Leardmann and colleagues (2009) studied OEF/OIF veterans from all branches of the U.S. armed forces and found that around 7% of their sample met criteria for PTSD. Milliken and colleagues (2007) studied active duty and reserve service members and found PTSD rates between 12% (active duty) and 13% (reserves). These researchers also found rates of major depression between 5% (active duty) and 4% (reserves). Seal et al. (2007) conducted a study of OEF/OIF veterans and found that 13% of those veterans met criteria for PTSD and 5% met criteria for major depression.



Prevalence of PTSD/MDD in U.S. Civilian, Military, and Navy Samples		
Civilian	Military (post-deploy)	U.S. Navy (post-deploy)
<b>O'Donnell et al., 2004</b> <ul style="list-style-type: none"> <li>PTSD: 4%</li> <li>MDD: 6%</li> </ul>	<b>Hoge et al., 2006</b> <ul style="list-style-type: none"> <li>PTSD: 9.8%</li> <li>MDD: 4.5%</li> </ul>	<b>Ford (2009)</b> <ul style="list-style-type: none"> <li>PTSD: 13%</li> <li>MDD: 7.5%</li> </ul>
<b>Kessler et al., 2005</b> <ul style="list-style-type: none"> <li>PTSD: 3.5%</li> <li>MDD: 6.7%</li> </ul>	<b>Milliken et al., 2007</b> <ul style="list-style-type: none"> <li>PTSD: 11.8%</li> <li>MDD: 4.7%</li> </ul>	<b>Johnston &amp; Dipp, 2009</b> <ul style="list-style-type: none"> <li>PTSD: 6%</li> </ul>
<b>Karlin et al., 2003</b> <ul style="list-style-type: none"> <li>PTSD: 3.1%</li> <li>MDD: 5.9%</li> </ul>	<b>Schell &amp; Marshall, 2008</b> <ul style="list-style-type: none"> <li>PTSD: 14%</li> <li>MDD: 14%</li> </ul>	<b>Shen et al., 2009</b> <ul style="list-style-type: none"> <li>PTSD: 4%</li> </ul>

#### *Prevalence of PTSD/MDD in U.S. Navy Populations*

Several recent studies have been conducted on rates of PTSD and/or depression seen in Sailors and Marines returning from OEF/OIF deployments (Ford, 2009; Johnston & Dipp, 2009; Shen et al., 2009). Ford (2009) assessed 2,616 U.S. Navy personnel around 3 to 6 months post-deployment for risk for depression and post traumatic stress disorder. This researcher found that around 7.5% met criteria for a depressive disorder and 13% met criteria for post traumatic stress disorder. Johnston and Dipp (2009) assessed 976 Sailors and Marines upon return from OIF deployment. These researchers found PTSD occurring at rates of around 6% when service members were assessed via Post-Deployment Health Assessment. Johnston and Dipp (2009) did not assess major depression rates in their study. Shen and colleagues (2009) analyzed data on 112,720 U.S. Navy personnel within 30 days of return from deployment using the

Post-Deployment Health Assessment (PDHA) and found that 4% of those personnel met criteria for PTSD. These researchers also assessed PTSD rates in U.S. Navy personnel deployed to various locations and found that around 10% of those assessed post-deployment to Iraq met criteria for PTSD, 5% of those assessed post-deployment to Afghanistan, and 3% of those assessed post-deployment from sea duty (Shen et al., 2009). Shen and colleagues (2009) did not assess rates of major depression in their study. Finally, there was one last intriguing study found on mental health in the U.S. Navy. Marietta and colleagues (2005) looked at the top reasons for medical discharge in the U.S. Navy during OEF/OIF combat operations. These researchers found that mental health problems (types of diagnoses were not specified) were one of the most common reasons for medical discharge in the U.S. Navy, second only to orthopedic injuries.

#### *Predictors of PTSD and MDD in Adult Populations*

In their review of civilian studies assessing predictors of PTSD, Ozer and colleagues (2003) found that pre-trauma problems associated with increased PTSD symptoms in trauma victims included both prior mental health treatment (e.g., Carlier, Lamberts, Gersons, 1997; Jeavons, Greenwood, & Horne, 2000) and presence of pre-trauma mood disorders (Resnick, Kilpatrick, Best, & Kramer, 1992; Shalev, Freedman, et al., 1998; Ursano et al., 1999). Additional studies have supported this finding that pre-trauma psychiatric problems appear to increase the likelihood of developing both PTSD and depression following trauma (i.e., Breslau & Davis, 1992; McFarlane, 1989).

O'Donnell and colleagues (2004) conducted a study in which they assessed predictors that increased the likelihood of PTSD, depression, and Comorbid PTSD/depression at three months as well as 12 months post-trauma. At three months post-trauma, variables that showed higher probability of predicting PTSD alone included psychiatric history and the presence of depression. At three months post-trauma, variables that showed higher probability of predicting depression alone included psychiatric history and alcohol use pre-trauma. Finally, at three months post-trauma, variables that showed a higher probability of predicting comorbid PTSD/depression included event severity, psychiatric history, and the presence of depression. O'Donnell and colleagues (2004) followed up with the same subjects at 12 months. Also at 12 months post-trauma, variables that showed a higher probability of PTSD alone included event severity and psychiatric history. At 12 months post-trauma, the only variable that showed a higher probability of predicting depression alone was event severity. Finally, at 12 months post-trauma, variables that showed a higher probability for predicting comorbid PTSD/depression were event severity and psychiatric history (O'Donnell et al., 2004). It is important to note that the presence of depression after trauma was predictive of the onset of PTSD and comorbid PTSD/depression at three months post-trauma. These findings seem to indicate that early post-trauma depression serves as a predictor of later PTSD and comorbid PTSD/depression.

### *Military Deployment Factors Associated with PTSD and MDD*

There have been only a few studies that have assessed deployment related factors in the U.S. Navy and their association with PTSD and depression in Navy personnel. These studies address combat exposure (Riddle et al., 2004; Smith et al., 2008), number of deployments (Shen et al., 2009), and pre-deployment mental health treatment (McNulty, 2005). No studies have been found to date that have assessed the association of Navy component type or immediate post-deployment mental health symptoms to mental health outcomes in U.S. Navy personnel 3 to 6 months post-deployment. The majority of research on military deployment factors associated with PTSD and major depression has been conducted using United States Army and United Kingdom Army personnel.

#### *Combat Exposure*

Many studies of U.S. and U.K. military personnel that have shown a positive relationship between combat exposure and PTSD symptoms (e.g., Hoge et al., 2006; Hoge et al., 2004; Hotopf et al., 2006; Rona et al., 2009; Wells et al., 2010; Wolfe et al., 1999). Hoge and colleagues (2004) showed that PTSD prevalence had a positive relationship with the number of firefights (i.e., combat) experienced by military personnel. Specifically, these researchers found the following percentages of combat-related PTSD: no firefights (4.5%), 1-2 firefights (9.3%), 3-5 firefights (12.7%), and 5 or more (19.3%). Hoge and colleagues (2006) found that 79.6% of the military personnel who had screened positive for PTSD post-deployment to Iraq had either engaged in direct combat or had seen people wounded and/or killed. In their assessment of Gulf War veterans, Wolfe

and colleagues (1999) found that Soldiers who had experienced combat during the Persian Gulf War were significantly more likely to meet criteria for PTSD than those who had not experienced combat. In a recent assessment of post-deployment depression, Wells and colleagues (2010) found that deployed service members with combat exposures were twice as likely as those without combat exposure to have new onset depression.

In their study of U.K. military personnel deployed in support of OIF, Hotopf and colleagues (2006) found that personnel assigned to combat units (vs. support units) showed increased rates of PTSD symptoms post-deployment. This increase was attributed to intensity of combat exposure. Rona and colleagues (2009) assessed U.K. military personnel post-OIF deployment and found that combat exposures such as “seeing personnel wounded or killed” and “came under small arms fire” were associated with increased PTSD prevalence. Specifically, if U.K. military personnel reported “seeing personnel wounded or killed” they were 9 times as likely to meet criteria for PTSD as were those who did not report. Those U.K. military personnel who reported that they “came under small arms fire” were 12 times as likely as to meet criteria for PTSD than those that did not report.

Only one study to date was found that directly addressed the relationship between combat exposure and post-deployment mental health in U.S. Navy personnel (i.e., Smith et al., 2008). Smith and colleagues (2008) assessed data from U.S. Navy veterans ( $n = 1,478$ ) who had deployed in support of OEF/OIF between 2001 and 2003. They found that Navy personnel who reported exposure

to combat during their deployment were two and a half times as likely to meet criteria for PTSD than were Navy personnel who did not report exposure to combat during deployment. One other study of deployed U.S. Navy personnel provided findings that were related to mental health while conducting combat support missions. In their study of hospitalization aboard U.S. Navy ships, Riddle and colleagues (2004) found that work-related injury, operational stress, and mental illness were the top three contributors to Navy personnel being placed in inpatient medical care during deployment.

#### *Prior Deployments*

Past research on the impact of prior military deployments and post-deployment mental health tended to show that prior deployments either have little to no effect on post-deployment mental health outcomes (e.g., Milliken et al., 2007; Ritzer et al., 1999; Rona et al., 2007) or that prior deployments reduce the occurrence of post-deployment mental health outcomes in subsequent deployments (e.g., Adler et al., 2005; Martinez et al., 2000; Solomon, 1993). Milliken and colleagues (2007) assessed post-deployment mental health risk in Soldiers with only one deployment as well as Soldiers with multiple deployments. These researchers found that roughly 25% of multiple deployers met risk criteria for mental health disorders whereas 28% of one-time deployers met criteria. These rates were not significantly different from one another. Ritzer and colleagues (1999) assessed Soldiers who had deployed to Bosnia over a three year time frame and found that the number of deployments was not predictive of poor post-deployment psychological health. Finally, in their assessment of U.K.

military personnel deployed to Iraq, Rona and colleagues (2007) found no association between the number of deployments made by military personnel and those personnel's post-deployment psychological symptoms, including PTSD and depression.

Other researchers (i.e., Adler et al., 2005; Martinez et al., 2000; Solomon, 1993) who have assessed the impact of prior deployments on post-deployment mental health actually found that having an increased number of deployments promoted a decrease in poor mental health outcomes. Adler and colleagues (2005) found that U.S. Army personnel who had prior deployment experience in the Balkans between 1996 and 1998 reported significantly less psychological distress than did other personnel who had deployed to the Balkans only once. Martinez and colleagues (2001) also found that Soldiers with prior deployments to the Balkans in 1999 reported less psychological distress on measures of depression and PTSD than did Soldiers who had only one deployment to the area. In his text on combat stress reactions, Solomon (1993) suggested that previous deployment experience may lead to the development of both adequate coping strategies and appropriate deployment expectations which could reduce the amount of psychological distress experienced in subsequent military deployments.

Again, only one study could be found that assessed the relationship between prior deployments and post-deployment mental health in U.S. Navy personnel. Shen and colleagues (2009) conducted research on the effects of deployment on PTSD in deployed U.S. Navy personnel. These researchers

found that, in terms of number of deployments, Navy personnel who had a prior deployment within 36 months of their current deployment were more likely to screen positive for PTSD than were Navy personnel with no prior deployments. The findings of this one study appear to contradict the findings of other studies assessing deployment frequency in U.S. Army and U.K. military personnel, studies which showed that deployment history either had no effect on post-deployment mental health (e.g., Milliken et al., 2007; Rona et al., 2007) or that prior deployments increased service member resilience to mental health risks (e.g., Adler et al., 2005). It is possible that this difference in the effect of multiple deployments is either due to methodological differences between research studies, such as prior deployments measured as dichotomous (i.e., yes/no) or continuous variables (i.e., 1, 2, 3 deployments) or perhaps the difference is due to actual differences in Navy personnel's reactions to deployment. Another difference between Shen and colleagues (2009) and this current study is that Shen and colleagues (2009) research on post-deployment risk for post traumatic stress disorder was cross-sectional whereas our current research study was prospective across the deployment cycle. Both Milliken and colleagues (2007) and Rona and colleagues (2009) followed military personnel prospectively across the deployment cycle. It is possible that the difference between cross-sectional research (e.g., Shen et al., 2009) and prospective research (e.g., Milliken et al., 2007; Rona et al., 2009) is driving which body of research is supported by current study findings. Further research with U.S. Navy personnel is needed to clarify the difference in these findings.



### *Service Component*

Each branch of the U.S. armed services is composed of two components: active duty and reserve forces. The active component of the armed services includes service members who serve in a full-time, active duty status (DoD, 2008). The reserve component of the armed services includes service members who serve in a part-time, reserve status for a minimum of one weekend per month and two weeks of training per year (U.S. Navy Reserve, 2009). The reserve component of the U.S. armed services includes Reserve (USA, USN, & USMC) as well as National Guard (USA & USAF) personnel (DoD, 2008). Jaycox and Tanielian (2008) note that use of reserve forces in support of OEF/OIF combat operations has been historically high, as this continues to be true with the reserve forces making up the following percentages of troops deployed in support of OEF/OIF: 14% U.S. Army Reserves (i.e., 110,164 personnel), 9 % U.S. Navy Reserves (i.e., 27,456 personnel), 10% U.S. Air Force Reserves (i.e., 32,845 personnel), and 15% U.S. Marine Corps Reserves (i.e., 30,398 personnel).

Researchers have studied the impact of service component type on post-deployment mental health in military personnel deployed during the Persian Gulf War as well as personnel deployed during OEF/OIF (Friedman, 2004; Kang et al., 2003; Milliken et al., 2007; Wolfe et al., 1999). In their assessment of Gulf War veterans, Wolfe and colleagues (1999) found that National Guard and reserve personnel were twice as likely to meet PTSD criteria than were active duty personnel from the same deployment. Friedman (2004) discussed the fact

that National Guard and reserve troops made up an increasing portion of military personnel deployed in support of OEF/OIF. Friedman (2004) cites the fact that National Guard and Reserve forces hold full time civilian jobs, are not part of a full-time military culture like active duty forces, and may not live near a military installation. Furthermore, Reserve personnel have less access to support services offered through the military and, thus, may receive less care and support post-deployment than their active duty counterparts. Finally, Friedman (2004) posits that the same factors affecting Reserve component forces in OEF/OIF may be able to explain why researchers saw similar increased rates of PTSD and depression in Reserve component forces during the Persian Gulf War when compared to active duty. Kang and colleagues (2003), in a study of 30,000 veterans, found that of all the military in their sample who met criteria for PTSD there was a higher percentage of National Guard and Reserve component personnel (i.e., 68%) than there was active duty personnel (i.e., 31%) from the same study time period.

In a recent study of OEF/OIF returnees, Milliken and colleagues (2007), using matched Post Deployment Health Assessment (PDHA) and Post Deployment Health Reassessment (PDHRA) forms, found similar percentages of reserve and active duty Soldiers reporting mental health concerns (17.5% vs. 17%, respectively) immediately post-deployment. However, when those same mental health concerns were measured in the same cohort at six months, the percentage difference was significant between reserve component and active duty Soldiers (35.5% vs. 27%, respectively). Not only did reserve personnel

report a greater percentage of mental health concerns on the PDHRA forms, but these personnel were also referred to mental health providers in significantly higher percentages than their active duty counterparts (36% vs. 14.7%, respectively) (Milliken et al., 2007). These researchers cite potential contributing factors such as lack of military unit cohesion and stress associated with transitioning from active duty Soldiers back to civilian workers.

#### *Immediate Post-Deployment PTSD/MDD Symptoms*

Little research has been conducted assessing the influence of early post-deployment mental health symptoms on later post-deployment mental health. There was only one study (i.e., Milliken et al., 2007) that looked at the impact of immediate post-deployment mental health on later mental health in a military sample. Milliken and colleagues (2007) found that reports of mental health concerns increased significantly between Soldiers completion of the PDHA (i.e.,  $\leq 30$  days post-deployment) and their completion of the PDHRA (i.e., 3 to 6 months post-deployment). Specifically, rates of PTSD symptom reporting increased from 11.8% (PDHA) to 16.7% (PDHRA) and rates of depression symptom reporting increased from 4.7% (PDHA) to 10.3% (PDHRA). Milliken and colleagues (2007) also noted that around 50% of those Soldiers who indicated symptoms of PTSD and/or depression immediately post-deployment had recovered by 3 to 6 months post-deployment. However, these researchers reported that two times as many new cases of PTSD and/or depression were present 3 to 6 months post-deployment for deployed veterans (Milliken et al., 2007). There were no studies found that had looked at the impact of immediate

post-deployment mental health symptoms on later post-deployment mental health of U.S. Navy personnel.

### *Pre-Deployment Mental Health*

There was no U.S. military research found that studied the association of pre-deployment mental health treatment with whether service members met risk for PTSD and/or major depression following their deployment. Some research using United Kingdom military forces has looked at the relationship between pre-deployment mental health and post-deployment mental health outcomes (e.g., Rona et al., 2009). Rona and colleagues (2009) assessed the pre-deployment mental health of 1,885 U.K. military personnel and then followed up with those same military personnel after their deployment to Iraq. These researchers found that the presence of psychological symptoms, in this case PTSD symptoms and what these researchers had termed as general psychological distress, prior to deployment were significantly associated with meeting criteria for PTSD following deployment.

There was one study that assessed the effects of pre-deployment mental health care in Navy personnel. In a recent study of U.S. Navy personnel, McNulty (2005) reported that 30% of the sample (n = 1,195) had sought counseling (i.e., individual or family) prior to deployment. Those service members who had sought counseling prior to deployment showed an increased ability to cope with problems that arose both during deployment and post-deployment than those personnel who had not sought prior counseling (McNulty, 2005). This study provides interesting findings concerning pre-deployment mental health care that

may differ from those seen in other military studies (e.g., Rona et al., 2009); however, this comparison must be made with caution since McNulty (2005) did not measure post-deployment mental health outcomes (as in Rona et al., 2009) but rather the impact of pre-deployment mental health counseling on U.S. Navy personnel's abilities to cope with problems following deployment.

#### *Comorbidity and Co-occurrence of PTSD and MDD*

A number of studies conducted outside the U.S. military have reported significant associations (i.e., comorbidity and co-occurrence) between PTSD and major depression. Kessler and colleagues (2005) found that PTSD and major depression were moderately correlated ( $r = .50$ ) in many individuals. O'Donnell and colleagues (2004) found that the majority of individuals with PTSD (i.e., 63%) at 3 months post-trauma still met criteria for PTSD, MDD, or both at 12 months. Other studies of civilian populations have reported high occurrence of co-morbid depression in individuals diagnosed with PTSD (e.g., Breslau et al., 1997).

Breslau and colleagues (1997) found evidence of possible causal pathways that could be used to explain the close association of depression and PTSD. First, they showed that pre-trauma major depression increases the likelihood of meeting criteria for PTSD following traumatic events. Second, they also found that pre-existing PTSD significantly increases the overall likelihood of initial onset of major depression. All of the research to date on the co-morbidity/co-occurrence of PTSD and depression has been conducted using civilian samples. No studies could be found that assessed comorbid and co-occurring PTSD and depression in military samples.

### *Impact of Early Post-Trauma Depressive/PTSD Symptoms*

Studies have assessed the relationship of early post-trauma depressive symptoms and subsequent PTSD symptom severity (Breslau et al., 1991; Shalev et al., 1998) in U.S. and Israeli civilian samples. Breslau and colleagues (1991) found that depressive symptoms in individuals with PTSD were predictive of increased PTSD symptom severity. Shalev and colleagues (1998) also found that presence of depressive symptoms in individuals with PTSD were predictive of increased PTSD symptom severity when compared to individuals with only PTSD. Specifically, these researchers showed that having comorbid PTSD and major depression at 1 month post-trauma was significantly predictive of increased PTSD symptom severity at 4 months (Shalev et al., 1998).

Research in civilian samples has also found that individuals who met criteria for major depression pre-trauma were more susceptible to meeting criteria for PTSD following trauma (Breslau et al., 1998; Breslau et al., 2000). Other researchers have found that the presence of PTSD in traumatized individuals is predictive of the development of major depression in those individuals (North et al., 2004; O'Donnell et al., 2004). Still other researchers have compared individuals with PTSD only to those with comorbid PTSD/depression and found that those with comorbid diagnoses of PTSD/depression showed greater comorbid medical problems (Kimerling, 2004) and higher rates of suicide attempts (Oquendo et al., 2005). Finally, Pietrzak and colleagues (2009) found that individuals with PTSD scored significantly higher on the PHQ-9 depression measure than did individuals without PTSD. Furthermore,

they found that individuals who screened positive for depression on PHQ-9 were more likely to have been previously diagnosed with PTSD (Pietrzak et al., 2009).

*Pre-Deployment Health Assessment, Post-Deployment Health Assessment, and Post-Deployment Health Reassessment Use in Research Studies*

The Deployment Health Clinical Center (DHCC) is a DoD center designed to handle health related aspects of military deployments. Information regarding the Pre-Deployment Health Assessment (DD2795), Post-Deployment Health Assessment (DD2796), and Post-Deployment Health Reassessment (DD2900) can be found at the DHCC website, [www.pdhealth.mil](http://www.pdhealth.mil). The DD2795 was implemented by the DoD in May 1999 and was designed to screen service members for potential health concerns prior to deployment. The DD2795 is required to be completed at least 30 days prior to deployment. The DD2796 was implemented by the DoD in May 2003 and was designed to assess physical and mental health concerns immediately following deployment. The DD2796 is required to be completed either in-theater during out-processing or within 30 days of returning home from deployment. The DD2900 was implemented in March 2005 and was designed to assess physical and mental health concerns related to deployment that have emerged over time. The DD2900 is required to be completed between three to six months after service member's return from deployment.

One study was found that used data from the Pre-Deployment Health Assessment (Pre-DHA) to study mental health outcomes in a deployed sample (i.e., Andres, 2008). Andres (2008) did not report either strengths or weaknesses

to the use of the Pre-DHA in research on mental health of military service members. Another study assessed the validity of the Pre-DHA in terms of predicting the presence of pre-deployment mental health diagnoses (i.e., Nevin, 2009). Nevin (2009) found that of the 615 service members who had been diagnosed with a mental health disorder within one year pre-deployment, only 36% (n = 224) reported that they had sought care for mental health. He concluded that service member's self-report of pre-deployment mental health care had low validity in terms of identifying service members actually diagnosed with mental health disorders within one year pre-deployment (Nevin, 2009). In other words, there was a low level of self-report of mental health treatment prior to deployment on the DD2795 even among those service members documented as seeking mental health treatment within one year pre-deployment.

Studies that have assessed mental health of deployed military service members using the Post-Deployment Health Assessment (PDHA) and Post-Deployment Health Reassessment (PDHRA) reported both strengths and weaknesses to these types of measures (i.e., Andres, 2008; Hoge et al., 2006; MacGregor et al., 2009; Milliken et al., 2007; Shen et al., 2009). Andres (2008) in his research using the PDHA recommended that future research incorporate data from the PDHRA since many mental health conditions do not manifest within first 30 days post-deployment. Hoge and colleagues (2006), in their research using the PDHA, showed that the mental health screens (i.e., PC-PTSD and PHQ-2) in this form served as a good marker for deployment-related mental health outcomes at the population level; however, these researchers expressed



concerns about the usefulness of the PDHA as a predictive measure for health service utilization. MacGregor and colleagues (2009) reported in their study that the PDHA was useful for comparing Navy population to other military populations (e.g., U.S. Army, U.S. Marine Corps) who had been assessed with the PDHA immediately post-deployment; however, these researchers also felt that PDHA data likely overestimated the presence of PTSD and depression in their sample due to the ease of which the service member could meet risk criteria for either depression or PTSD. Milliken and colleagues (2007) reported that the PDHA and PDHRA were not redundant measures of post-deployment health issues, but rather identify issues in two largely distinct cohorts (i.e., immediately post-deployment and 3 to 6 months post deployment). Finally, Shen and colleagues (2009) suggest that stigma likely plays a role in service members' responses on the PDHA and could result in under-reporting of mental health problems. These researchers also felt that the administration of the PDHA within 30 days of deployment could miss mental health problems that do not typically manifest until much later. The increase in symptoms more than 30 days post-deployment was also a major reason for the institution of the Post-Deployment Health Reassessment that captured symptoms 3 to 6 months post-deployment.

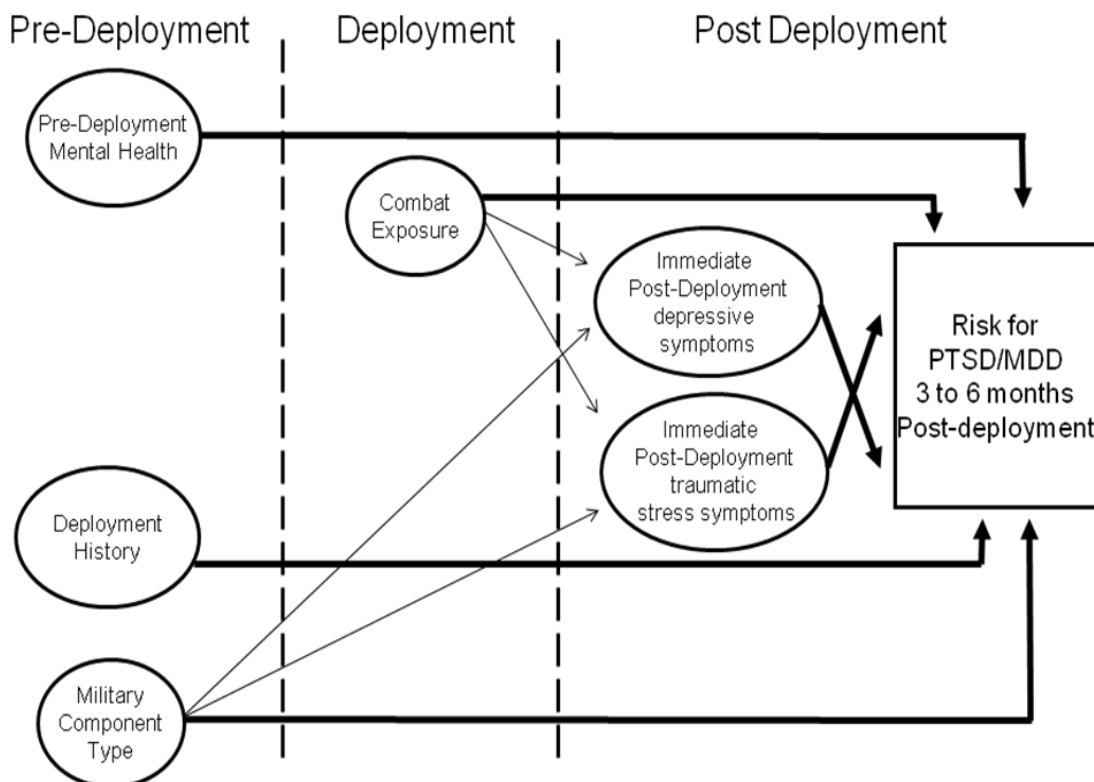
### *Study Rationale*

Much of the research on mental health in military personnel deployed in support of Operations Enduring Freedom and Iraqi Freedom has been conducted using U.S. Marine Corps and U.S. Army personnel (e.g., Hoge et al., 2006; Hoge et al., 2004; Hotopf et al., 2006; Milliken et al., 2007). These research studies

have contributed greatly to our understanding of the mental health impacts of combat operations. However, that has been little research assessing deployment-related mental health in U.S. Navy personnel during OEF/OIF (i.e., Smith et al., 2008; Shen et al., 2009). These studies address limited areas of deployment including combat exposure and number of deployments. In their recent report to Congress, Jaycox and Tanielian (2008) cite a lack of research on the effects of deployment in the U.S. Navy as well as in reserve component military personnel. Our study will assess the influence of combat exposure, prior deployment history, and immediate risk for depression and post traumatic stress disorder on risk for depression and/or post traumatic stress disorder 3 to 6 months post-deployment in both active duty and reserve Navy personnel. Additionally, when reviewing the military deployment literature, no studies were found that assessed mental health risk prospectively throughout the deployment cycle. Our study will look at factors that influence Navy service members' risk for depressive disorders and/or post traumatic stress disorder from pre-deployment through 3 – 6 months post-deployment. Finally, there has been some research conducted in civilian populations on the influence of early post-trauma depression on post traumatic stress symptoms (e.g., Breslau et al., 1991; North et al., 2004; O'Donnell et al., 2004; Shalev et al., 1998). No research has been found on the influence of early post-trauma depression on post traumatic symptoms in military personnel. Our study will likely be one of the first to look at the influence of post traumatic and/or depressive symptoms within 30 days post-

deployment (i.e., early symptom reporting) on post traumatic and/or depressive symptoms 3 – 6 months post-deployment in a military sample.

### *Conceptual Model*



The conceptual model proposed for this dissertation research implies both direct effects and indirect effects. For example, the arrows that are in bold are predicting a direct effect between a particular predictor and the outcome variables. Direct effects proposed in this model have been shown in research using military samples. However, the majority of these direct relationships (with the exception of combat exposure and deployment history) have not been assessed in a U.S. Navy sample. Therefore, the hypotheses and main statistical analyses in this dissertation study will focus on these direct effects.

However, it is important to note that the conceptual model for this study also indicates the potential for indirect (or mediating) effects with some of the variables. In particular, there is a possibility that immediate symptoms of depression and immediate symptoms of post traumatic stress disorder could mediate the relationships of component type and combat exposure to risk for depression and post traumatic stress disorder 3 to 6 months post-deployment. This dissertation research will assess the indirect effects of these potential mediators as part of the study analyses.

### *Hypotheses*

In this study, it was proposed that deployment-related factors of combat exposure, prior deployment history, Navy component type, immediate post-deployment symptoms of depression and/or post traumatic stress disorder, and pre-deployment mental health care will be significant predictors of Navy's personnel's risk for depression and/or post traumatic stress disorder 3 to 6 months post-deployment. Based on the gathered evidence and guided by the direct relationships shown in the conceptual model, five hypotheses were generated for this research.

First, it was predicted that U.S. Navy personnel exposed to combat would be at increased risk for depression and/or post traumatic stress disorder 3 to 6 months post-deployment compared to those personnel not exposed to combat. This hypothesis was based on prior research conducted with Soldiers, Marines, and military veterans which found that exposure to combat increased risk for post traumatic stress disorder and depression in these populations (i.e., Hoge et al.,

2006; Hoge et al., 2004; Wells et al., 2010). The second hypothesis predicted that Navy personnel with one or more prior deployments would show decreased risk for depression and/or post traumatic stress disorder 3 to 6 months post-deployment as compared to those personnel returning from their initial deployment. The research supporting this hypothesis was conducted with Soldiers and found that the number of prior deployments either had no effect on post-deployment mental health outcomes (i.e., Milliken et al., 2007) or that Soldiers with past deployments displayed significantly less risk for poor mental health outcomes than did those deploying for the first time (i.e., Adler et al., 2005). The third hypothesis of this study predicted that Navy personnel in the Reserve component would be at greater risk for depression and/or post traumatic stress disorder 3 to 6 months post-deployment compared to their Active Duty counterparts. This hypothesis was based on past research that assessed mental health outcomes in Soldiers and military veterans returning from OEF/OIF deployments (i.e., Milliken et al., 2007) as well as Gulf War deployments (i.e., Kang et al., 2003), which found that Reserve component service members consistently showed higher levels of post traumatic stress disorder and depression following deployment than did their Active Duty counterparts.

The fourth hypothesis involved the relationship between mental health symptoms immediately post-deployment and risk for depression and/or post traumatic stress disorder 3 to 6 months post-deployment. Specifically, it was hypothesized that Navy personnel's symptoms of depression and/or post traumatic stress immediately following deployment would predict depression

and/or post traumatic stress disorder 3 to 6 months post-deployment. There was only one study found that had looked at the influence of depressive and traumatic stress symptoms immediately following deployment on risk for depression and/or post traumatic stress 3 to 6 months post-deployment (i.e., Milliken et al., 2007). Milliken and colleagues (2007) found that, among deployed U.S. Army personnel, rates of post traumatic stress symptoms as well as depressive symptoms increased significantly from immediate post-deployment assessment to assessment 3 to 6 months post-deployment. However, these researchers did not look at the influence of depressive symptoms on later risk for post-traumatic stress disorder nor did they assess the influence of early post traumatic stress symptoms on later risk for depression. The current study has been designed to assess the influence early post-deployment depressive symptoms on later risk for post traumatic stress disorder as well as the influence of early post-deployment traumatic stress symptoms on later risk for depression.

The fifth, and final, hypothesis of this study predicted that Navy personnel that had sought mental health care prior to deployment would be more likely to be at risk for depression and/or post traumatic stress disorder 3 to 6 months post-deployment than would those personnel who had not sought mental health care. Support for this hypothesis came from research conducted with United Kingdom Soldiers who had deployed in support of OIF (i.e., Rona et al., 2009). Rona and colleagues (2009) followed these Soldiers from before deployment to immediately after deployment and found that those Soldiers with psychological

symptoms prior to deployment were at higher risk for meeting criteria for post traumatic stress disorder following deployment.

## Method

### *Study Participants*

Study participants included all active duty and reserve United States Navy personnel who had deployed between June 01, 2005 and December 31, 2009 in support of either Operation Enduring Freedom (OEF) or Operation Iraqi Freedom (OIF). These personnel were separated into two study samples based on the completion of the following mandatory Department of Defense (DoD) deployment forms: Pre-Deployment Health Assessment (DD2795), Post Deployment Health Assessment (DD2796), and Post Deployment Health Reassessment (DD2900). The first study sample contained 1,052 United States Navy personnel of all ages and ranks who had completed at least one Post-Deployment Health Assessment (DD2796) matched with one Post-Deployment Health Reassessment (DD2900) following the same deployment. The second study sample contained 687 United States Navy personnel of all ages and ranks who had completed at least one Pre-Deployment Health Assessment (DD2795), matched with one Post-Deployment Health Assessment (DD2796) within 30 days following their deployment, and, finally, matched with one Post Deployment Health Reassessment (DD2900) within 3 to 6 months following the same deployment. All responses to assessment items were confidential. These two study samples of 687 (i.e., full deployment sample) and 1,052 (i.e., post-deployment sample) United States Navy personnel were separated and analyzed from a larger data

set of military personnel from all branches of the armed services previously gathered from a Department of Defense database at Armed Forces Health Surveillance Center (AFHSC). In order to determine whether these two samples were comparable to one another in terms of key study variables, frequency and chi-square analyses were conducted.

In the post-deployment data set ( $n = 1,052$ ), we found the following demographic percentages: gender (87% Male vs. 13% Female), marital status (63% Married vs. 37% Not Married), age (22% 18-24, 20% 25-29, 37% 30-39, and 21% 40 and above), rank (81% Enlisted vs. 19% Officer), and deployment location (24% OEF vs. 76% OIF). In terms of predictor variables in post-deployment data set, we found: combat exposure (38% Yes vs. 62% No), prior deployments (63% No Prior vs. 37% 1 or More Prior), component type (70% Active Duty vs. 30% Reserve), immediate post-deployment depression (9% At Risk vs. 91% Not At Risk), and immediate post-deployment post traumatic stress disorder (5.5% At Risk vs. 94.5% Not At Risk). In terms of outcome variables in post-deployment data set, we found: 3 to 6 months post-deployment depression (6% At Risk vs. 94% Not At Risk) and 3 to 6 months post-deployment post traumatic stress disorder (9% At Risk vs. 91% Not At Risk).

In the full deployment data set ( $n = 687$ ), we found the following demographic percentages: gender (85% Male vs. 15% Female), marital status (64% Married vs. 36% Not Married), age (19% 18-24, 21% 25-29, 38% 30-39, and 22% 40 and above), rank (81% Enlisted vs. 19% Officer), and deployment location (27% OEF vs. 73% OIF). In terms of predictor variables in post-



deployment data set, we found: combat exposure (38% Yes vs. 62% No), prior deployments (69% No Prior vs. 31% 1 or More Prior), component type (68% Active Duty vs. 32% Reserve), immediate post-deployment depression (8% At Risk vs. 92% Not At Risk), immediate post-deployment post traumatic stress disorder (5.5% At Risk vs. 94.5% Not At Risk), and pre-deployment mental health care (2% Yes vs. 98% No). In terms of outcome variables in post-deployment data set, we found: 3 to 6 months post-deployment depression (6% At Risk vs. 94% Not At Risk) and 3 to 6 months post-deployment post traumatic stress disorder (10% At Risk vs. 90% Not At Risk).

It is important to note that because of the manner in which the two deployment data sets were coded there was some overlap in terms of data contained in both sets. In order to be included in to the full deployment data set, Navy personnel will have completed a matched set of Pre-Deployment Health Assessment (DD2795), Post-Deployment Health Assessment (DD2796), and Post-Deployment Health Reassessment (DD2900). In order to be included in the post deployment data set, Navy personnel would only have completed a matched set of Post-Deployment Health Assessment (DD2796) and Post-Deployment Health Reassessment (DD2900). Therefore, all of the personnel from the full deployment data set were included in the post deployment data set. In summary, there were a total of 1,052 personnel in the post-deployment data, only 365 of those personnel were unique to that data set once you controlled for the 687 personnel included from the full deployment data set. Please see Table 1 for side by side comparison of descriptive data from both data sets.

Recent Department of Defense statistics in terms of demographic in the U.S. Navy show the following percentages of demographic data: gender (Male 85% vs. Female 15%), marital status (Married 58% vs. Not Married 42%), and rank (Enlisted 84% vs. Officer 16%) (DMDC, 2006). In terms of current study data, the post-deployment data set (n = 1,052) had the following demographic percentages: gender (87% Male vs. 13% Female), marital status (63% Married vs. 37% Not Married), and rank (81% Enlisted vs. 19% Officer). The full deployment data set (n = 687) had the following demographic percentages: gender (85% Male vs. 15% Female), marital status (64% Married vs. 36% Not Married), and rank (81% Enlisted vs. 19% Officer). Key demographic variables in the two study data sets were closely comparable to recent demographics of the U.S. Navy overall.

All study variables (i.e., demographic, predictor, and outcome) from personnel unique to each of the two data sets (i.e., 365 post-deployment vs. 687 full deployment) were compared statistically via chi-square analyses to determine if any variable in the post-deployment data set varied significantly from the corresponding variable in the full deployment data set. Frequency analyses showed that both data sets (i.e., post-deployment and full deployment) had similar percentages in demographics, predictor variables, and outcome variables. Pearson chi square test results indicated that the majority of the variables (i.e., gender, marital status, age, rank, pre-deployment mental health treatment, combat exposure, immediate MDD risk, immediate PTSD risk, MDD risk 3 to 6 months post-deployment, and PTSD risk 3 to 6 months post-deployment) did not

differ significantly across both data sets. However, there were several variables that did differ significantly between post-deployment data and full deployment data. Those variables included: deployment location, component type, and prior deployment history. Specifically, Navy personnel from the post-deployment data set were significantly more likely to be on active duty, to have been deployed to OIF, and to have no prior deployments. It is important to note that although significant, these differences are relatively small (i.e., less than 10% between data sets). Overall, it is believed that each data set was suitable for comparison with the other (See Table 1).

### *Procedure*

All data used in this study met HIPAA criteria for privacy and confidentiality. Both data sets of U.S. Navy personnel contained a subject identifier, date of DD2795 completion, date of DD2796 completion, date of DD2900 completion, deployment date, service member's age, gender, self-reported marital status, service branch, and pay grade as well as location of deployment.

### *Predictor Variables*

#### *Combat Exposure*

Data on combat exposure came from the DD2796 form and included Navy personnel's answers to items 7, 8, and 9. Item seven on the DD2796 asked: "Did you see anyone wounded, killed or dead during this deployment?" Navy personnel had the option of selecting all that apply out of the following answers: "No", "Yes – coalition", "Yes – enemy", and "Yes – civilian". Item eight on

DD2796 asked: "Were you engaged in direct combat where you discharged your weapon?" Navy personnel had the option to select either "No" or "Yes."

Furthermore, if they indicated "Yes" on item eight, then Navy personnel were to indicate whether the weapon was discharged on "land", "sea", and/or "air." Item nine on DD2796 asked: "During this deployment, did you ever feel that you were in great danger of being killed?" Navy personnel had the option to select "No" or "Yes" as answer for this question. All three of the DD2796 questions related to combat exposure were condensed into a single dichotomous predictor variable which was entitled "combat exposure." A "Yes" answer on any of the three combined questions was coded as an exposure to combat. Therefore if Navy personnel answered "Yes" to any of the combined three questions, then those personnel were considered to be exposed to combat. The decision to combine these three questions into a single predictor was consistent with other research studies using the Post Deployment Health Assessment (DD2796) who have also condensed these three questions into a single measure of combat exposure (e.g., Hoge et al., 2006; Milliken et al., 2007).

#### *Prior Deployment History*

Data on prior deployments came from the demographics section of the DD2900, where Navy personnel were able to indicate the total number of deployments that they have had in the past five years to Operation Iraqi Freedom, Operation Enduring Freedom, or Other. There were options to select either "1", "2", "3", "4", or "5 or more" under OIF, OEF, or Other. For the purposes of this dissertation research, prior deployment history was scored as a

dichotomy. If one or more deployments to OEF/OIF/Other were indicated on the DD2900, then those personnel were coded as having prior deployment history; if no deployments to OEF/OIF/Other were indicated on the DD2900, then those personnel were coded as having no prior deployment history.

### *Component Type*

Data on component type came from the demographics section of the DD2795, where Navy personnel were able to indicate whether they are “Active Duty” or “Reserve” component.

### *Pre-Deployment Mental Health Treatment*

Item seven on the DD2795 asked: “During the last year, have you sought counseling or care for your mental health?” There were options to select either “Yes” or “No” to this question.

### *Immediate Risk for Depression*

Item 11 on the DD2796 asked: “Over the LAST TWO WEEKS, how often have you been bothered by any of the following problems? a) Little interest or pleasure in doing things, b) Feeling down, depressed, or hopeless. There were options to select either “None”, “Some”, and “A Lot” as their answer to each part of this question.

### *Immediate Risk for Post Traumatic Stress Disorder*

Item 12 on the DD2796 was a four part question that asked: “Have you ever had any experience that was so frightening, horrible, or upsetting that, IN THE PAST MONTH, you ....a) Have had any nightmares about it or thought about it when you did not want to?, b) Tried hard not to think about it or went out

of your way to avoid situations that remind you of it?, c) Were constantly on guard, watchful, or easily startled?, and d) Felt numb or detached from others, activities, or your surroundings?” Navy personnel had the option to select either “Yes” or “No” as their answer to each of the four parts of this question.

### *Outcome Variables*

#### *Risk for Depression 3 to 6 Months Post-Deployment*

Item 11 on the DD2900 forms asked: “Over the LAST TWO WEEKS, how often have you been bothered by any of the following problems? a) Little interest or pleasure in doing things, b) Feeling down, depressed, or hopeless. There were options to select either “None”, “Some”, and “A Lot” as their answer to each part of this question.

#### *Risk for Post Traumatic Stress Disorder 3 to 6 Months Post-Deployment*

Item 9 on the DD2900 was a four part question that asked: “Have you ever had any experience that was so frightening, horrible, or upsetting that, IN THE PAST MONTH, you ....a) Have had any nightmares about it or thought about it when you did not want to?, b) Tried hard not to think about it or went out of your way to avoid situations that remind you of it?, c) Were constantly on guard, watchful, or easily startled?, and d) Felt numb or detached from others, activities, or your surroundings?” Navy personnel had the option to select either “Yes” or “No” as their answer to each of the four parts of this question.

### *Analysis of DoD Deployment Related Forms*

Unlike DD2795 pre-deployment screening form, the PDHA (DD2796) and PDHRA (DD2900) contain measures specifically formatted to screen for

depression and PTSD symptoms. These measures have been validated in both military (e.g., Adler, Wright, Huffman, Thomas, & Castro, 2002; Adler, Huffman, Bliese, & Castro, 2005; Wright, Huffman, Adler, & Castro, 2002; Wright, Thomas, et al., 2005) and civilian populations (e.g., Brown, Leonard, Saunders, & Papasouliotis, 2001; Kroenke et al., 2003; Oiumette et al., 2008). This current study assessed risk criteria for depression and/or post traumatic stress disorder with the Patient Health Questionnaire 2 (PHQ-2) and the Primary Care PTSD Screen (PC-PTSD). Both of these screening instruments were used in the PDHA and PDHRA forms and were found to be predictive of depression and PTSD in military personnel.

Both the PDHA and PDHRA forms contain the same 4-item screener for post-traumatic stress disorder (PTSD). This screener was developed by the National Center for PTSD and is called the Primary Care PTSD Screen (PC-PTSD). The PC-PTSD is comprised of a question formed by four separate parts covering key PTSD symptoms including avoidance of traumatic cues, re-experiencing of traumatic event, physical/psychological numbing, and hyperarousal symptoms. In 2004, the PC-PTSD was integrated into the Post-Deployment Health Assessment (PDHA) by the Department of Defense and was added to the Post-Deployment Health Reassessment (PDHRA) later that same year. The cut-off scores for risk for post traumatic stress disorder on the PC-PTSD include service member selection of two or more of the four symptom items. Cut-off scores of two or more have been demonstrated valid in other studies that have used PC-PTSD to assess risk for post traumatic stress disorder

(e.g., Bliese, Wright, Adler, Hoge, & Prayner, 2005; Hoge et al., 2006; Milliken et al., 2007). In one study (i.e., Prins et al., 2003) assessing the validity and reliability of the PC-PTSD scale, all participants' PC-PTSD scores were gathered at participant recruitment were then compared to participants' PC-PTSD scores at study follow up (around 1 month post-experiment). These two distinct measurement periods were used to test reliability. The PC-PTSD showed good test-retest reliability,  $r = 0.83$ . The PC-PTSD was also shown to be positively correlated with the Clinician Administered PTSD Scale (CAPS),  $r = 0.83$ , thus showing convergent validity (Prins et al., 2003).

Both the PDHA and PDHRA forms also contain the same two-item Patient Health Questionnaire (PHQ-2) screening tool that assesses for depression. The PHQ-2 is made up of the first two items contained in the original nine item version of the Patient Health Questionnaire (PHQ-9). These two items address individuals' depressed mood and loss of interest in pleasurable activities. For each response item (e.g., "not at all", "several days", "more than half the days", and "nearly everyday", scores of 0, 1, 2, 3 were assigned respectively. Scores on the PHQ-2 ranged from 0 – 6. Kroenke et al (2003) recommend a cut-off score of three or more on the PHQ-2 to detect risk for depression. Individuals scoring three or more on the PHQ-2 were then later assessed for major depression with 83% sensitivity and 92% specificity (Kroenke et al., 2003).

The PHQ-2 score of 3 or more was comparable to a clinician administered PHQ-9 for any depressive disorder ( $k = 0.62$  vs.  $0.58$ ) as well as for major depressive disorder ( $k = 0.48$  vs.  $0.54$ ) which shows that the PHQ-2 has good



criterion validity (Kroenke et al., 2003). Strong associations between high scores on the PHQ-2 and reduction patient functioning as measured by the Medical Outcomes Study Short-Form General Health Survey (SF-20) demonstrated strong construct validity. In other words, the PHQ-2 was most strongly correlated with the SF-20 domain for mental health,  $r = .70$ . The PHQ-2 demonstrated solid convergent validity with other instruments that measured depressive symptoms such as the Hospital Anxiety and Depression Scale (HADS),  $r = .67$  (Lowe et al., 2004). Divergent validity in terms of the PHQ-2 was shown by comparing the PHQ-2 with other measures that were less related to depression, such as the physical component of the Short Form Health Survey-12,  $r = -0.23$  (Lowe et al., 2004). Lowe and colleagues (2004) also proved the PHQ-2 to be a reliable instrument with good internal consistency,  $\alpha = 0.83$ . Test-retest reliability scores for the PHQ-2 were 0.81 and 0.96 (Lowe et al., 2004).

### *Statistical Analyses*

The study hypotheses were analyzed using multivariate logistic regression analyses. Meeting criteria for depression and for post traumatic stress disorder 3 to 6 months post-deployment were the dependent variables. Primary independent variables included combat exposure, prior deployment history, Navy component type, immediate post-deployment mental health symptoms, and the presence of pre-deployment mental health care. The first four study hypotheses were assessed via regression analyses using data from both post-deployment ( $n = 1,052$ ) and full deployment ( $n = 687$ ) samples. The final hypothesis concerning

pre-deployment mental health care was assessed via regression analysis using only data from the full deployment ( $n = 687$ ) sample.

### *Confounding Variables*

Potential confounders from the data gathered in the post-deployment and full deployment data sets included age, rank, gender, marital status, and deployment location. These potential confounding variables were chosen because they have been shown in other research on mental health outcomes to influence risk for depression and post traumatic stress disorder. In terms of age, some researchers (e.g., Seal et al., 2007) have shown that younger military service members are at increased risk for both depression and PTSD when compared to older service members. In terms of rank, Gahm and colleagues (2007) found that junior enlisted personnel (i.e., E1 – E4) were at increased risk for depression and PTSD when compared to senior enlisted and officers. In terms of gender, some researchers using civilian samples (e.g., Kessler et al., 2005) have shown that women are at increased risk for lifetime diagnosis of depression and PTSD when compared to men. Some military studies (e.g., Gahm et al., 2007) have shown that male service members are at increased risk for depression and PTSD when compared to female service members. In terms of marital status, some researchers (e.g., Kessler et al., 2005) have found that previously married individuals are at higher risk for depression and PTSD when compared to married individuals. One study assessed multiple factors associated with mental health in Navy personnel have found that psychological distress (i.e., high levels of anxiety) was related to demographic factors such as

age, rank, and current mental health care (McNulty, 2005). Finally, in terms of deployment location, Hoge and colleagues (2006) found that rates of depression and PTSD varied significantly based on deployment location with increased risk in those deployed in support of OIF versus those deployed in support of OEF. Other researchers have assessed PTSD rates in U.S. Navy personnel deployed to various locations and found that around 10% of those assessed post-deployment to Iraq met criteria for PTSD, 5% of those assessed post-deployment to Afghanistan, and 3% of those assessed post-deployment from sea duty (Shen et al., 2009).

In order to reduce number of predictor variables used in our regression model, a backward stepwise regression method was used for each outcome variable in both data sets. The backward stepwise regression placed all potential confounders along with proposed predictors into the models. The stepwise method then calculated the contribution of each of these potential confounders using the significance found in a t-test of each predictor (Field, 2006). If a potential confounder was not making a significant contribution to the model in terms of predicting the outcome variables, then that variable was removed from the final logistic regression models. The models were re-estimated using the remaining confounders (Field, 2006). Primary independent variables were forced into the models at each stage. The reason that a backwards stepwise regression method was used was for reducing the likelihood that a potential significant predictor would be masked by suppressor effects. Suppressor effects occur when a certain predictor variable has a significant effect on the outcome

variable(s) but only when another predictor is being held constant (such as what occurs in a forward stepwise regression method). Forward stepwise regression would be more likely to exclude a predictor that is involved in suppressor effects (Field, 2006). Thus, using backward stepwise regression analyses likely reduced the risk of missing a potentially significant predictor (i.e., Type II error) that should be included in all of the regression models. All potential predictor variables that met study inclusion criteria of  $p < 0.10$  within the backward stepwise regression method were entered into the final logistic regression models.

### *Post Hoc Analyses*

In order to assess for mediation among the independent variables in the regression models, unadjusted odds ratios were calculated and potential mediation effects were assessed via the Baron and Kenny (1986) mediation model. Baron and Kenny (1986) discuss a statistical means for determining mediation using regression analysis. Their model consists of four steps. First, the researcher must show that a predictor variable is correlated with an outcome variable of interest. The unadjusted odds ratio between the predictor variable and outcome variable was estimated in this step. Next, the researcher must show that the predictor variable in question is correlated with a potential mediator variable. The unadjusted odds ratio between the predictor variable and mediator variable was estimated in this step. In the third step, the researcher must show that the potential mediator variable affects the outcome variable. It is important to note that, during this third step, the predictor and the mediator must be entered as predictors in the model and then correlated with the outcome variable in

question. A separate logistic regression model containing only the predictor and mediator as independent variables and the outcome as the dependent variable was estimated in this step. The fourth and final step of the Baron and Kenny (1986) mediation model is to establish whether the mediator variable fully mediates the predictor variable's effect on the outcome variable. The odds ratios from Steps 1 and 3 were compared for this final step.

If all four steps of the Baron and Kenny (1986) mediation model are met, then the mediator variable in question is determined to have fully mediated the effect of the initial predictor variable on the outcome variable. However, if only the first three steps of this model hold true and the predictor effect on the outcome variable is still significant (albeit with a weakened effect), then the mediator variable in question is determined to have only partially mediated the relationship between the predictor and outcome variables (Baron, & Kenny, 1986). Findings from the mediation model analyses are reported in the results section and reviewed in the discussion section of this study.

## Results

### *Overview of Analyses*

Four separate backwards stepwise logistic regression models were used in this study to assess associations between outcome variables of risk for depression and risk for post traumatic stress disorder 3 to 6 months post-deployment and predictor variables of combat exposure: (yes vs. no), prior deployments: (no prior vs. prior), component type: (active duty vs. reserve), immediate post-deployment risk for depression: (at risk vs. not at risk), immediate

post-deployment risk for post traumatic stress disorder: (at risk vs. not at risk), and pre-deployment mental health care. These regression analyses were performed on two separate sets of data, one post-deployment data set of 1,052 U.S. Navy personnel and one full deployment data set of 687 U.S. Navy personnel.

In addition to these four regression models, unadjusted odds ratios were calculated to address potential mediation effects as described previously in the conceptual framework model of this dissertation study. According to the original conceptual model, potential mediator variables included combat exposure, immediate post deployment symptoms of depression, and immediate post-deployment symptoms of post traumatic stress disorder. Unadjusted odds ratios were performed on both the post-deployment sample ( $n = 1,052$ ) and the full deployment sample ( $n = 687$ ).

### *Descriptives*

Frequency and chi-square analyses showed that both data sets (i.e., post-deployment and full deployment) were very similar in that the majority of U.S. Navy personnel contained within were male, married, enlisted, ages 30 – 39, and had deployed to Iraq. This similarity implies that each data set was suitably comparable with the other. See Table 1 for side by side comparison of descriptive data from both data sets.

### *Main Analyses*

All initial logistic regression models included the following potential confounding variables: service member gender, marital status, age, rank, and

deployment location. None of these confounding variables were statistically significant in the full deployment sample and were removed from regression models using a backwards stepwise selection algorithm. Most of the potential confounders were also removed from regression models using the post-deployment sample with the exception of rank. Therefore, the final two regression models for the full deployment sample included the following variables: pre-deployment mental health care, combat exposure, immediate post-deployment risk for depression, immediate post-deployment risk for post traumatic stress disorder, component type, and deployment history. The final two regression models for the post-deployment sample included the following variables: combat exposure, immediate post-deployment risk for depression, immediate post-deployment risk for post traumatic stress disorder, component type, deployment history, and Navy personnel rank (i.e., officer vs. enlisted).

For the post-deployment data set ( $n = 1,052$ ), it was hypothesized that combat exposure, prior deployments, component type, immediate post-deployment risk for depression, and immediate post-deployment risk for post traumatic stress disorder would be associated with U.S. Navy personnel risk for depression and/or post traumatic stress disorder around 3 to 6 months post-deployment. In order for these predictions to be supported, we would expect significant relationships between risk for depression and/or post traumatic stress disorder around 3 to 6 months post-deployment and U.S. Navy personnel's exposure to combat, prior deployments, component type, immediate post-

deployment risk for depression, and immediate post-deployment risk for post traumatic stress disorder. See Table 2 for a review of study hypotheses.

*Hypothesis 1:* Depression 3 to 6 months post-deployment was not associated with exposure to combat after adjusting to other variables in the regression model; however, unadjusted odds ratios (see Table 6) show 67% higher odds of meeting risk criteria for depression among those Navy personnel exposed to combat (OR = 1.67, CI 95% = 1.01-2.74). This finding suggests that the association between combat exposure and risk for depression 3 to 6 months post-deployment is mediated by other variables in this regression model. In particular, when running unadjusted odds ratios, it was found that immediate post-deployment symptoms of depression are strongly related to both combat exposure (OR = 2.44, CI 95% = 1.60-3.80) and risk for depression 3 to 6 months post-deployment (OR = 9.97, CI 95% = 5.74-17.33). However, when immediate depressive symptoms were included in the assessment of the relationship between combat exposure and risk for depression 3 to 6 months post-deployment, the relationship between combat exposure and risk for depression 3 to 6 months post-deployment was no longer significant (OR = 1.25, 95% CI = 0.74 – 2.14). This finding appears to show that immediate post-deployment symptoms of depression fully mediate the relationship between combat exposure and risk for depression 3 to 6 months post-deployment.

Exposure to combat did predict PTSD 3 to 6 months post-deployment (OR = 3.13, 95% CI = 1.92-5.13) after adjusting for prior deployment history, component type, immediate risk for depression, immediate risk for PTSD, and



rank. The adjusted odds ratio is similar to the unadjusted odds ratio of 3.35 (95% CI = 2.16-5.20) indicating that the association between combat exposure and risk for PTSD 3 to 6 months post-deployment is not likely mediated by other variables in the model. However, when a mediation model was tested, it was found that immediate post-deployment symptoms of PTSD are strongly related to both combat exposure (OR = 8.64, CI 95% = 4.32-17.30) and risk for PTSD 3 to 6 months post-deployment (OR = 10.56, CI 95% = 5.97-18.70). When immediate PTSD symptoms were included in the assessment of the relationship between combat exposure and risk for PTSD 3 to 6 months post-deployment, the relationship between combat exposure and risk for PTSD 3 to 6 months post-deployment was weakened but still significant (OR = 2.46, 95% CI = 1.54 – 3.90). This finding appears to show that immediate post-deployment PTSD symptoms partially mediate the relationship between combat exposure and risk for PTSD 3 to 6 months post-deployment.

*Hypothesis 2:* Service members with prior deployment experience were not more likely to meet criteria for depression or post traumatic stress disorder at 3 – 6 months post-deployment, regardless of whether the analyses adjusted for other variables.

*Hypothesis 3:* Reserve Component status during deployment did predict depression 3 to 6 months post-deployment (OR = 2.05, 95% CI = 1.15-3.65) as well as post traumatic stress disorder 3 to 6 months post-deployment (OR = 3.50, 95% CI = 2.12-5.78).

*Hypothesis 4a and 4b:* Risk for depression immediately post-deployment was predictive of depression 3 to 6 months post-deployment (OR = 6.94, 95% CI = 3.75-12.84). Also risk for post traumatic stress disorder immediately post-deployment was predictive of depression 3 to 6 months post-deployment (OR = 3.21, 95% CI = 1.45-7.13). In continuing to report findings on our fourth set of hypotheses, risk for post-traumatic stress disorder 3 to 6 months post-deployment was predicted by being at risk for depression immediately post-deployment (OR = 1.98, 95% CI = 1.05-3.75). Those who met risk criteria for post traumatic stress disorder immediately post-deployment also experienced increased risk for post traumatic stress disorder 3 to 6 months post-deployment (OR = 6.68, 95% CI = 3.40-13.13).

Finally, it was found that officers were 60% less likely to be at for PTSD 3 to 6 months post-deployment (OR = 0.40, 95% CI = 0.18-0.87). Navy personnel's rank was not associated with risk for depression 3 to 6 months post-deployment after adjusting to other variables in the regression model.

For full deployment, it was hypothesized that pre-deployment mental health care, combat exposure, prior deployments, component type, immediate post-deployment risk for depression, and immediate post-deployment risk for post traumatic stress disorder will predict depression and/or post traumatic stress disorder at 3 to 6 months post-deployment.

*Hypothesis 5:* Meeting risk for depression or post traumatic stress disorder 3 to 6 months post-deployment was not associated with whether Navy service members sought mental health care pre-deployment after adjusting to other

variables in the regression model (Table 4); however, unadjusted odds ratios (see Table 5) show four times higher odds of meeting risk criteria for depression among those Navy personnel who sought pre-deployment mental health care (OR = 4.20, CI 95% = 1.13-15.66). This finding suggests that the association between pre-deployment mental health care and risk for depression 3 to 6 months post-deployment is mediated by other variables in this regression model. In particular, when running unadjusted odds ratios, it was found that immediate post-deployment symptoms of depression are strongly related to both pre-deployment mental health care (OR = 6.63, CI 95% = 2.15-20.52) and risk for depression 3 to 6 months post-deployment (OR = 12.10, CI 95% = 6.13-23.90). However, when immediate depressive symptoms were included in the assessment of the relationship between pre-deployment mental health care and risk for depression 3 to 6 months post-deployment, the relationship between pre-deployment mental health care and risk for depression 3 to 6 months post-deployment was no longer significant (OR = 1.90, 95% CI = 0.42 – 8.48). These findings appear to show that immediate post-deployment symptoms of depression fully mediate the relationship between pre-deployment mental health care and risk for depression 3 to 6 months post-deployment.

Additionally, unadjusted odds ratios (see Table 5) show nearly four times higher odds of meeting risk criteria for post traumatic stress disorder among those Navy personnel who sought pre-deployment mental health care (OR = 3.87, CI 95% = 1.18-12.71). This finding suggests that the association between pre-deployment mental health care and risk for post traumatic stress disorder 3

to 6 months post-deployment is mediated by other variables in this regression model. In particular, when running unadjusted odds ratios, it was found that immediate post-deployment symptoms of post traumatic stress disorder are strongly related to both pre-deployment mental health care (OR = 5.13, CI 95% = 1.40-19.23) and risk for PTSD 3 to 6 months post-deployment (OR = 8.94, CI 95% = 4.40-18.21). However, when immediate post traumatic stress symptoms were included in the assessment of the relationship between pre-deployment mental health care and risk for PTSD 3 to 6 months post-deployment, the relationship between pre-deployment mental health care and risk for PTSD 3 to 6 months post-deployment was no longer significant (OR = 2.73, 95% CI = 0.73–10.15). This finding appears to show that immediate post-deployment symptoms of post traumatic stress disorder fully mediate the relationship between pre-deployment mental health care and risk for PTSD 3 to 6 months post-deployment.

In the full deployment data set, it was observed that personnel from the Reserve component were nearly 3 times as likely to be at risk for depression 3 to 6 months post-deployment than were personnel from the Active Duty component (OR = 2.70, 95% CI = 1.32-5.50). Furthermore, it was observed that the personnel from the Reserve component were nearly 4 times as likely to be at risk for post traumatic stress disorder than were personnel from the Active Duty component (OR = 3.81, 95% CI = 2.11-6.85).

All other significant findings from full deployment data set were similar to findings from post-deployment data set. Depression 3 to 6 months post-

deployment was not associated with exposure to combat; however, exposure to combat did predict PTSD 3 to 6 months post-deployment (OR = 2.57, 95% CI = 1.45-4.57). Service members with prior deployment experience were not more likely to meet criterion for depression or post traumatic stress disorder at 3 – 6 months post-deployment. Risk for depression immediately post-deployment was predictive of depression 3 to 6 months post-deployment (OR = 7.81, 95% CI = 3.71-16.46). Also risk for post traumatic stress disorder immediately post-deployment was predictive of depression 3 to 6 months post-deployment (OR = 5.14, 95% CI = 2.08-14.07). In continuing to report findings on our fourth set of hypotheses, risk for post-traumatic stress disorder 3 to 6 months post-deployment was predicted by being at risk for depression immediately post-deployment (OR = 2.02, 95% CI = 0.94-4.33). Those who met risk criteria for post traumatic stress disorder immediately post-deployment also experienced increased risk for post traumatic stress disorder 3 to 6 months post-deployment (OR = 6.37, 95% CI = 2.78-14.60).

### Discussion

Navy personnel exposed to combat were at increased risk for post traumatic stress disorder 3 to 6 months post-deployment; however, no association was found between combat exposure and risk for depression 3 to 6 months following deployment. Furthermore, there were no associations found between prior deployments and risk for depression or post traumatic stress disorder 3 to 6 months post-deployment. Reserve personnel were at increased risk for depression as well as increased risk for post traumatic stress disorder 3

to 6 months following deployment. Navy personnel with immediate depressive symptoms were at increased risk for depression as well as at more risk for post traumatic stress disorder 3 to 6 months post-deployment. Likewise, those personnel with immediate traumatic stress symptoms were at increased risk for both depression and post traumatic stress disorder 3 to 6 months following their deployment. Navy officers were at decreased risk for post traumatic stress disorder 3 to 6 months post-deployment; however, no association was found between rank and risk for depression 3 to 6 months post-deployment. Last of all, there was no association found between pre-deployment mental health care and risk for depression or post traumatic stress disorder 3 to 6 months post-deployment.

Navy personnel serve integral roles in multiple OEF/OIF operations. The U.S. Navy is involved in direct combat OEF/OIF missions (e.g., hospital corpsman, SEALs, air strikes, afloat battle formations) as well as medical/logistics support from the sea, from the air, and from “boots on the ground” Sailors (e.g., Seabees, Individual Augmentees, medical staff). Since the beginning of OEF/OIF combat operations, Navy aircraft carrier battle groups have deployed for an average of 7 to 10 months, compared with previous deployments that lasted 6 months (McNulty, 2005). Furthermore, as these campaigns have persisted, more and more U.S. Navy personnel have been deployed in support of ground operations in OEF and OIF (Shen et al., 2009). Navy deployments represent around 19% of all active duty military troop deployments in support of OEF/OIF which is second only to U.S. Army (approx.

52% of all deployment) and exceeds the number of troop deployments in both the U.S. Marine Corps (i.e., 15%) and U.S. Air Force (i.e., 15%) (DMDC, 2008). U.S. Navy personnel serve many unique roles in the field of battle and, yet, the potential increased risk for PTSD and/or depression in U.S. Navy personnel has not been studied to the same extent as with Soldiers and Marines.

This study's findings gave partial support for the hypotheses dealing with combat exposure and risk for depression and post traumatic stress disorder 3 to 6 months post-deployment. This initial hypothesis explored the influence of combat exposure on Navy personnel's risk for depression as well as their risk for post traumatic stress disorder. The findings indicated that risk for post traumatic stress disorder 3 to 6 months post-deployment was significantly associated with exposure to combat. Other researchers have shown that combat exposure during deployment is a risk factor for post traumatic stress disorder 3 to 6 months post-deployment in military samples (e.g., Hoge et al., 2006; Hotopf et al., 2006; Wells et al., 2010). One study on combat and PTSD in a U.S. Navy sample also supported our findings in showing that Navy personnel who had been exposed to combat were more likely to be diagnosed with PTSD following their deployment than those personnel who were not exposed to combat (Smith et al., 2008). This current research supports findings from other military research in that U.S. Navy personnel are being exposed to combat during their deployments and that this exposure is placing those personnel at heightened risk for post traumatic stress disorder. This study's findings also indicate that Navy personnel are meeting risk criteria for post traumatic stress disorder in percentages similar to those seen in

other armed services (i.e., U.S. Army and U.S. Marine Corps) deployed in support of OEF/OIF.

The second portion of our first hypothesis examined the influence of combat exposure on Navy personnel's risk for depression. The risk for depression 3 to 6 months post-deployment did not appear to be directly related to U.S. Navy personnel's exposure to combat. Although this study hypothesized that combat exposure would be directly related to risk for depression 3 to 6 months post-deployment, the conceptual model proposed in the beginning of this study allowed for both direct and indirect effects of combat exposure on risk for depression 3 to 6 months post-deployment. When the relationship between combat exposure and depression 3 to 6 months post-deployment was explored via a mediation model, it was found that Navy personnel's immediate post-deployment symptoms of depression fully mediated the relationship between the initial predictor and outcome variables. In other words, when the mediating effects of immediate symptoms of depression were controlled for in a mediation model, a significant relationship between combat exposure and risk for depression 3 to 6 months post-deployment emerged. Thus, in terms of combat exposure and risk for depression 3 to 6 months post-deployment, the findings suggest that there is no direct association only an indirect association that is mediated by immediate post-deployment symptoms of depression.

A review of the literature showed that, although many studies reported findings on the association between combat exposure and post traumatic stress disorder in Soldiers and Marines (e.g., Hoge et al., 2006; Hoge et al., 2004;



Milliken et al., 2007) and even a couple studies using a Navy sample (e.g., Shen et al., 2009; Smith et al., 2008), only one study had actually looked at the association between combat exposure and depression (i.e., Wells et al., 2010). Wells and colleagues (2010) found that deployed service members with combat exposures were twice as likely as those without combat exposure to have new onset depression. They assessed Post-OEF/OIF deployed active duty and veterans, including Navy personnel, for post-deployment depression and found that men and women with combat exposures during deployment had the highest occurrence of new onset depression, (5.7% and 15.7%, respectively), followed by those not deployed (3.9% and 7.7%, respectively), followed last by participants deployed without combat exposures exhibited the lowest occurrence (2.3% and 5.1%, respectively) (Wells et al., 2010). Wells and colleagues (2010) assessed active duty personnel and veterans longitudinally from 2001 through 2006; however, even though some of these individuals did deploy in support of OEF/OIF during this timeframe, these researchers did not follow the same individuals from pre-deployment through 3 to 6 months post-deployment. Therefore, without further research with active duty military samples, it is not known whether exposure to combat is rarely related to risk for depression 3 to 6 months post-deployment, whether this current study simply did not find a direct relationship, or if more research should control for mediating effects of immediate symptoms of depression and post traumatic stress following deployments.

The second study hypothesis assessed the influence of prior deployments on Navy personnel's risk for depression as well as their risk for post traumatic

stress disorder. There was no association between prior deployment history and Navy personnel's risk for depression. Additionally, we found no association between prior deployment history and Navy personnel's risk for post traumatic stress disorder. Please recall, that the prediction in this case was that prior deployment history would decrease risk for depression and/or PTSD 3 to 6 months post-deployment. Some researchers studying the effect of number of deployments on mental health outcomes have found data that supports our predictions (e.g., Milliken et al., 2007; Rona et al., 2009). Both sets of researchers found that multiple deployments did not appear to effect post-deployment mental health outcomes. In a potential explanation for these types of findings, Solomon (1993) suggested that previous deployment experience may lead to the development of both adequate coping strategies and appropriate deployment expectations which could reduce the amount of psychological distress experienced in subsequent military deployments. Other researchers (i.e., Shen et al., 2009) have found that Navy personnel with prior deployment history were more likely to be at risk for post traumatic stress disorder at 3 to 6 months post-deployment.

Therefore current study findings, while unsupported and contradictory to the research conducted by Shen and colleagues (2009), are indeed comparable to findings using other military samples (i.e., U.S. Marine Corps and U.S. Army). In other words, it appears that our lack of association between prior deployment and mental health outcome has been supported in the military literature across many of the U.S. armed services.

One plausible explanation for the direction of current study findings is the methodological differences seen in the supporting research. Shen and colleagues (2009) research on post-deployment risk for post traumatic stress disorder was cross-sectional whereas our current research study was prospective across the deployment cycle. Both Milliken and colleagues (2007) and Rona and colleagues (2009) followed military personnel prospectively across the deployment cycle. It is possible that the difference between cross-sectional research (e.g., Shen et al., 2009) and prospective research (e.g., Milliken et al., 2007; Rona et al., 2009) is driving which body of research is supported by current study findings. Additional research in the area of the effects of previous deployment history on mental health outcomes using U.S. Navy samples could help to direct our knowledge of this area toward the either the findings of Shen and colleagues (2009) or toward the findings of researchers using other military samples (e.g., Milliken et al., 2007; Rona et al. 2009).

The third study hypothesis looked at the impact of Navy component (i.e., Active Duty vs. Reserves) on personnel's risk for depression and/or post traumatic stress disorder 3 to 6 months post-deployment. Current study findings showed that Reserve component Navy personnel were at increased risk for depression and post traumatic stress disorder 3 to 6 months post-deployment than were their Active Duty counterparts. Other researchers using both prospective data (e.g., Milliken et al., 2007) and cross-sectional data (e.g., Kang et al., 2003) have shown that Reserve component forces tend to be at a higher

risk for depression and/or post traumatic stress disorder 3 to 6 months post-deployment.

The fourth study hypothesis evaluated the relationship between immediate post-deployment symptoms of depression and traumatic stress to Navy personnel's risk for depression and post traumatic stress disorder 3 to 6 months following deployment. Specifically, it was proposed that U.S. Navy personnel who were at risk for depression and/or post traumatic stress disorder immediately after deployment would be more likely to be at risk for depression and/or post traumatic stress disorder 3 to 6 months post-deployment than were those who did not show immediate risk. Study findings showed that risk for depression immediately post-deployment was related to increased risk for both depression and post traumatic stress disorder 3 to 6 months post-deployment. Likewise, it was found that risk for post traumatic stress immediately post-deployment was related to increased risk for both depression and post traumatic stress disorder 3 to 6 months post-deployment. Other literature on military deployments (i.e., Milliken et al., 2007) supports this finding that service members who show mental health symptoms immediately post-deployment are more likely to meet risk for mental health disorders 3 to 6 months post-deployment. However, no other military studies could be found that had specifically assessed the relationship between immediate post-deployment symptoms of depression and later risk for post traumatic stress disorder. Neither were there any military studies found that assessed the relationship between immediate symptoms of traumatic stress and later risk for depression.

However, research assessing the course of PTSD prospectively in civilian samples has shown results that support current study findings. Prospective research studies have shown that the presence of depressive symptoms in individuals with PTSD were predictive of increased PTSD symptoms severity (e.g., Shalev et al., 1998). Other researchers have shown that the presence of PTSD is predictive of depression in traumatized individuals (e.g., North et al., 2004; O'Donnell et al., 2004). It is possible that as more research is conducted on the relationship between early depressive symptoms on later risk for post traumatic stress disorder as well as the relationship of early traumatic stress symptoms on later risk for depression in military samples, there will continue to be additional parallel support for findings from civilian research.

Although not proposed in the study hypotheses, there was a significant association between Navy personnel's rank and their risk for post traumatic stress disorder 3 to 6 months post-deployment. The findings indicated that Navy officers were at less risk for post traumatic stress disorder 3 to 6 months post-deployment than were Navy enlisted personnel. There was no association between Navy personnel's rank and risk for depression 3 to 6 months post-deployment. Other researchers (i.e., Gahm et al., 2007; McNulty, 2005) have shown that rank has been a significant predictor of mental health outcomes in deployed military personnel. McNulty (2005) while looking at demographic factors that were related to psychological distress (i.e., high anxiety) in U.S. Navy personnel found that rank was a significant predictor of anxiety in deployed Navy personnel. Gahm and colleagues (2007) found that junior enlisted personnel (i.e.,

E1 – E4) were at increased risk for depression and PTSD compared to senior enlisted and officers. These researchers believed that these findings were due to the fact that junior enlisted personnel not only compose the largest percentage of overall deployed personnel but that junior enlisted personnel are more often exposed to combat during their deployments (Gahm et al., 2007). This reasoning may also be behind the current study finding on service member rank and risk for PTSD 3 to 6 months post-deployment.

The final study hypothesis explored the influence of pre-deployment mental health care on Navy personnel's risk for depression as well as their risk for post traumatic stress disorder 3 to 6 months post-deployment. There was no association found between pre-deployment mental health care and Navy personnel's risk for depression 3 to 6 months post-deployment. Additionally, there was no association found between pre-deployment mental health care and Navy personnel's risk for post traumatic stress disorder 3 to 6 months. Although the conceptual model proposed at the beginning of this study only indicated potential direct relationships between pre-deployment mental health care and both risk for depression and risk for PTSD 3 to 6 months post-deployment, post hoc analyses were conducted to determine if there were any indirect relationships amongst these variables. When the relationship between pre-deployment mental health care and depression 3 to 6 months post-deployment was explored via a mediation model, it was found that Navy personnel's immediate post-deployment symptoms of depression fully mediated the relationship between the initial predictor and outcome variables. In other words,

when the mediating effects of immediate symptoms of depression were controlled for in a mediation model, a significant relationship between pre-deployment mental health care and risk for depression 3 to 6 months post-deployment emerged. Furthermore, when the relationship between pre-deployment mental health care and PTSD 3 to 6 months post-deployment was explored via a mediation model, it was found that Navy personnel's immediate post-deployment symptoms of PTSD fully mediated the relationship between the initial predictor and outcome variables. In other words, when the mediating effects of immediate symptoms of PTSD were controlled for in a mediation model, a significant relationship between pre-deployment mental health care and risk for PTSD 3 to 6 months post-deployment emerged. Thus, in terms of the effects of pre-deployment mental health care on both risk for depression and risk for PTSD 3 to 6 months post-deployment, the findings suggest that there are no direct associations only indirect associations that are mediated by immediate post-deployment symptoms of depression and PTSD.

There have been studies in both military and civilian samples that have indicated that prior mental health care places individuals at higher risk for poor mental health outcome following a traumatic event. Rona and colleagues (2009), in their assessment of U.K. troop's deployment in support of OIF, found that the presence of psychological symptoms, in this case PTSD symptoms and general psychological distress, prior to deployment were significantly associated with the meeting criteria for PTSD following deployment. Studies of civilian samples also showed that individuals endorsing a history of mental health care prior to a

trauma showed increased risk for mental health problems (i.e., depression and PTSD) following a traumatic event (e.g., O'Donnell et al, 2004; Ozer et al., 2003; Shalev et al., 1998). There are a couple of plausible explanations concerning the absence of effect seen in direct associations between pre-deployment mental health care and U.S. Navy personnel's risk for depression and/or post-traumatic stress disorder 3 to 6 months post-deployment.

First, there was a very small percentage (i.e., 2%) of Navy personnel in the full deployment data set who indicated on their Pre-Deployment Health Assessments that they had received mental health care prior to deployment. Specifically, only 14 individuals out of the 687 individuals in this sample indicated that they had sought mental health care prior to deployment. It is possible that fear of stigmatization may have led to reduced levels of reporting by the service member (Shen et al, 2009). Support for fear of stigmatization on low levels of service member self-report of mental health treatment was provided by Nevin (2009) who showed in his study that less than 50% of service members with a diagnosed mental health disorder, as confirmed via medical records, actually indicated that they had sought counseling for mental health problems in the last 12 months on the Pre-Deployment Health Assessment. It is quite possible that stigma played an important role in the low levels of reporting of pre-deployment mental health treatment seeking in this current study. Please recall that this small pool of individuals comprised only 2% of our total sample. It is quite likely that this small number of individuals led to having an under-powered regression model. An under-powered regression analysis would make it difficult to determine



whether lack of significant difference indicates no association, or is due to under-representation of pre-deployment mental health seeking personnel in our sample.

Second, there is very little research on the impact of pre-deployment mental health care on post-deployment mental health symptoms. The only research study involving a military sample was Rona and colleagues (2009). These researchers did not use the same instruments to assess either pre-deployment mental health care or post-deployment mental health risk. In terms of civilian studies, many researchers have shown that prior mental health treatment predicts increased risk for post-trauma mental health problems (e.g., O'Donnell et al, 2004; Ozer et al., 2003; Shalev et al., 1998). However, it is possible that military deployment is not comparable to the traumas measured in these studies (i.e., assault, motor vehicle accidents).

Finally, it appears that certain mediator variables in the regression model were fully mediating the relationship between pre-deployment mental health care and depression as well as post traumatic stress disorder 3 to 6 months post-deployment. Therefore, although no direct associations were observed, there is evidence of indirect associations. The relationships in the mediation model between pre-deployment mental health care and depression as well as post traumatic stress disorder 3 to 6 months appear to support the findings shown by the majority of the civilian research on pre-trauma mental health care (i.e., O'Donnell et al., 2004; Ozer et al., 2003; Shalev et al., 1998) and military research on pre-deployment mental health care (i.e., Rona et al., 2009).

### *Study Limitations*

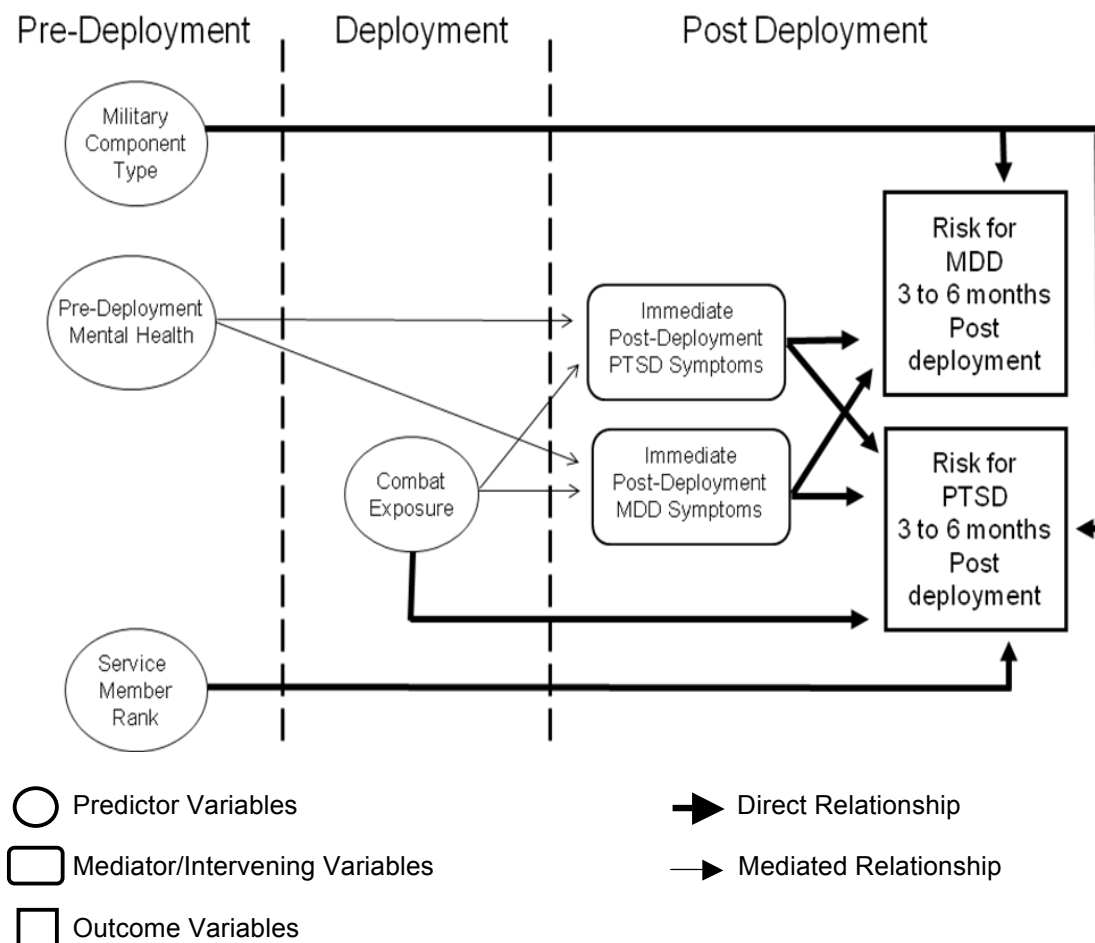
There are limitations to a study like this. Those limitations include: limited sample availability as well as potential sample bias. The first limitation involved the manner in which the data were pulled by AFHSA for this research. A data set of personnel who were matched in terms of completion of both post-deployment forms (i.e., DD2796 and DD2900) and a data set of personnel who were matched in terms of all three deployment health forms (i.e., DD2795, DD2796, and DD2900) were pulled from the AFHSA database. This matching of forms longitudinally across the deployment limited the available sample for this study. In other words, if each of the three deployment forms were pulled individually, there would have been greater numbers of subjects; however, since the subjects had to be matched across the same deployment cycle timeline in both the post-deployment and full deployment study samples, there was a reduction in the number of subjects. Therefore it is possible that these reduced samples of Navy personnel were not representative of the entire population of Navy personnel who had completed some or all of the three deployment forms. However, it does appear that key demographic variables in study samples match current demographic percentages in the U.S. navy overall. Recent Department of Defense statistics in terms of demographic in the U.S. Navy show the following percentages of demographic data: gender (Male 85% vs. Female 15%), marital status (Married 58% vs. Not Married 42%), and rank (Enlisted 84% vs. Officer 16%) (DMDC, 2006). In terms of current study data, the post-deployment data set (n = 1,052) had the following demographic percentages: gender (87% Male

vs. 13% Female), marital status (63% Married vs. 37% Not Married), and rank (81% Enlisted vs. 19% Officer). The full deployment data set (n = 687) had the following demographic percentages: gender (85% Male vs. 15% Female), marital status (64% Married vs. 36% Not Married), and rank (81% Enlisted vs. 19% Officer).

Another study limitation is potential for sample bias. Potential sample bias may occur if Navy personnel from the full deployment sample vary significantly from Navy personnel in the post-deployment sample. Significant differences between these two samples may likely impact our fifth hypothesis concerning pre-deployment mental health care and post-deployment mental health outcomes as well as differences in other findings (e.g., rank) between samples.

Consequences of this potential sample bias could be that the smaller full deployment cycle data may not generalize to U.S. Navy population overall. In order to assess for potential bias, descriptive analyses were conducted on both personnel from the full cycle deployment sample (n = 687) and personnel who were unique to the post-deployment sample (n = 365). Both of these samples were also compared to one another statistically using Pearson chi square tests. As shown in our results, samples were similar in demographic variables as well as predictor and outcome variable percentages (See Table 1).

### Conceptual Model Revisited



The revised conceptual model shown above is a visual description of the relationships found between variables as a result of dissertation analyses. Results of this dissertation study appear to show that there are both direct (i.e., bolded arrow) relationships and mediated (i.e., light arrow) relationships in the model. All of the direct relationships found in this dissertation research have been supported by other research using military samples (e.g., Hoge et al., 2006; Gahm et al., 2007; Milliken et al., 2007; Seal et al., 2007). One new direct relationship of rank on risk for PTSD 3 to 6 months post-deployment was added to the model. All of the current study's five hypotheses were based on direct

relationships between predictors and outcome variables. However, our initial conceptual model had also proposed some potential paths of mediation amongst the study variables.

This dissertation proposed that several variables (i.e., combat exposure, immediate symptoms of depression, and immediate symptoms of post traumatic stress disorder) may serve as mediators on the relationships of deployment history, component type, and combat exposure to risk for depression and post traumatic stress disorder 3 – 6 months post-deployment. Some of the potential mediation relationships in the original model were not found in this research; however, some (i.e., immediate symptoms of MDD/PTSD) were proven to mediate the relationship between pre-deployment mental health care and MDD/PTSD 3 to 6 months post-deployment as well as the relationship between combat exposure and MDD 3 to 6 months post-deployment. The final revision of this study's conceptual model accurately represents key predictor and mediator variables and their relationship with both study outcome variables in this sample.

### *Clinical Implications*

This study provides data that could ultimately provide significant clinical implications for the U.S. military. Prior to this current research, there has been very little research conducted in the area of post-deployment mental health outcomes in U.S. Navy personnel. More so, this research is one of the first to assess multiple risk factors (i.e., combat exposure, prior deployments, component type, early post-deployment mental health symptoms, and pre-deployment mental health care) across the entire deployment cycle and test their

associations with post-deployment mental health. While other researchers using Navy samples (i.e., Smith et al., 2008; Shen et al., 2009) have assessed post-deployment mental health outcomes, they have not focused on the entire deployment cycle from pre-deployment through 3 to 6 months post-deployment. This section will discuss some of the potential clinical implications to come out of this research.

First, this study has expanded our knowledge of the role of combat exposure and its effects on Navy personnel following deployment. Navy personnel, while not exposed to combat as often as Army or Marine Corp infantry personnel, still appeared to have significant exposure to combat during deployment. Furthermore, this research has shown that Navy personnel exposed to combat during deployments to OEF/OIF are showing risk for depression and post traumatic stress disorder at rates similar to those shown by U.S. Army and U.S. Marine Corps personnel returning from combat (see studies by Hoge and colleagues (2006) as well as Milliken and colleagues (2007)). Perhaps more consideration should be given to assessment and treatment of potential effects of combat exposure on U.S. Navy forces, especially individual augmentees, immediately upon return from deployment.

Next, this research provided further support for other research using military samples in terms of the impact of prior deployments on mental health outcomes of current deployment. Although we had predicted that presence of prior deployments would reduce risk for depression and/or post traumatic stress disorder as was shown in the research conducted with U.S. Army personnel

(e.g., Adler et al., 2005) , there is literature that has found that a history of prior deployments does not have a significant impact on post-deployment mental health problems (e.g., Milliken et al., 2007; Rona et al., 2007). These researchers found that multiple deployments did not appear to effect post-deployment health outcomes. Perhaps this current research would lead us to consider focusing on findings showing that prior deployment experience has either a protective effect or, at best, a neutral impact on risk for mental health problems following subsequent deployments.

Before this study, the effects of component type on post-deployment mental health had yet to be assessed in a Navy sample. The analyses of the both the post-deployment and full deployment samples of U.S. Navy personnel in this current study found that Reserve component Navy personnel were at higher risk for depression and/or post traumatic stress disorder than were their Active Duty counterparts. There is certainly a trend in current military research showing that U.S. Reserve forces are consistently showing increased risk for depression and post traumatic stress disorder 3 to 6 months post-deployment compared to Active Duty forces (e.g., Milliken et al., 2007; Kang et al., 2003). This current research bolsters other research findings and lends support to the fact that the Department of Defense must continue to find means for extending the care afforded to Active Duty service members to those service members in the Reserve forces.

A fourth implication of this current research is a deeper understanding of the influence of depressive symptoms and/or post traumatic stress symptoms

immediately post-deployment on future risk for a depression and/or post traumatic stress disorder 3 to 6 months post-deployment. Some researchers using military samples have shown a positive relationship between early depressive symptoms and later depression as well as early traumatic stress symptoms and later post traumatic stress disorder (e.g., Milliken et al., 2007). However, none of this research above speaks to the influence of early depressive symptoms on later risk for post traumatic stress disorder. Neither do these researchers comment on the influence of early traumatic stress symptoms on later risk for depression. In studies using civilian populations, some researchers have shown that the presence of depressive symptoms in individuals with PTSD were predictive of increased PTSD symptoms severity (e.g., Shalev et al., 1998) and other researchers have shown that the presence of PTSD is predictive of depression in traumatized individuals (e.g., North et al., 2004; O'Donnell et al., 2004). This current study supported both findings. Furthermore, this study is possibly one of the first to look at the influence of early post-deployment mental health symptoms on potential mental health outcomes 3 to 6 months post-deployment in a military sample. Military providers, specifically providers in the U.S. Navy, could use this information to create/modify treatment plans that address early interventions for both depression and post traumatic stress disorder.

Some civilian studies have already evaluated the impact of early interventions with depression and/or post traumatic stress disorder (e.g., Gidron et al., 2001; Resnick, Acierno, Holmes, Kilpatrick, & Jager, 1999). Gidron and



colleagues (2001) tested a two day phone-based intervention for acute stress symptoms experienced by victims of motor vehicle accidents that involved mainly supportive listening and brief psychoeducation. These researchers found that only 12% of those assessed 3 months later met criteria for post traumatic stress disorder versus 44% of the control condition. Resnick and colleagues (1999) offered recent sexual assault victims a 17-minute psychoeducation video regarding signs and symptoms of post traumatic stress disorder. These researchers found that only 33% of those who watched the video met criteria for post traumatic stress disorder 6 months post-incident whereas around 72% of those in control met criteria. Some military researchers, specifically researchers for the U.S. Army, have developed a program designed to aide in the prevention of long-term traumatic stress or depressive disorders (Adler, Bliese, McGurk, Hoge, & Castro, 2009). The program is known as Battlemind debriefing. Battlemind debriefing addresses difficulties associated with combat without recounting specific traumatic events. Furthermore, Battlemind debriefing emphasizes the transition from combat to home and takes a skills building approach to teaching service members techniques for post-deployment transition (Adler et al., 2009).

Finally, this study made an attempt to assess the effects of pre-deployment mental health on later post-deployment mental health risk. At the time of this current study, no research on the effects of previous mental health treatment on post-deployment mental health outcomes within military samples was found. The closest research assessing the effects of pre-deployment mental

health counseling in a military population was a study conducted by McNulty (2005). In a recent study of U.S. Navy personnel, McNulty (2005) reported that 30% of the sample ( $n = 1,195$ ) had sought counseling (i.e., individual or family) prior to deployment. Those service members who had sought counseling prior to deployment showed an increased ability to cope with problems that arose both during deployment and post-deployment than those personnel who had not sought prior counseling (McNulty, 2005). This study provides interesting findings concerning pre-deployment mental health care that may differ from those seen in other military studies (e.g., Rona et al., 2009); however, this comparison must be made with caution since McNulty (2005) did not measure post-deployment mental health outcomes (as in Rona et al., 2009), but rather the impact of pre-deployment mental health counseling on U.S. Navy personnel's abilities to cope with problems following deployment.

Some research in civilian populations has directly assessed the impact of prior mental health treatment on mental health outcomes following a traumatic event. These studies have shown that mental health treatment prior to a traumatic experience was a risk factor for post-trauma development of post traumatic stress disorder or increase in post-trauma depressive symptoms (i.e., Carlier et al., 1997; Jeavons et al., 2000). While our study did not find that pre-deployment mental health symptoms influence post-deployment mental health outcomes, it is possible that with a more robust sample we could show that prior mental health care could serve as a predictor of increased risk for depression and/or PTSD following a traumatic experience (e.g., combat exposure during

deployment) in military personnel as has been shown in civilian studies.

Likewise, it is possible that a more robust sample would replicate the findings of McNulty (2005) that showed that prior mental health counseling increased military personnel's abilities to cope with stressors following deployment.

### *Future Directions*

One possibility for future research involves assessing the reliability and validity of both the Post Deployment Health Assessment (PDHA) and the Post-Deployment Health Reassessment (PDHRA) forms in terms of their ability to accurately predict immediate post-deployment mental health symptoms as well as mental health symptoms 3 to 6 months after deployment. The results shown in this study came from data gathered from previously validated measures of depression (i.e., PHQ-2) and post traumatic stress disorder (i.e., PC PTSD). These measures are both embedded within the PDHA as well as the PDHRA along with other questions designed to assess the physical and mental health of military personnel following deployment. Few field studies have been conducted assessing validity of both the PDHA as well as the PDHRA in their abilities to predict both physical and mental health concerns in U.S. military personnel returning from deployment (Bliese, Wright, Adler, & Thomas, 2004; Bliese, Wright, Adler, Thomas, & Hoge, 2004). Furthermore, all of these validation studies were conducted in field settings with no formal experimental controls put in place. Some examples of potential controls not used in past validation research include: precise timing of PDHA/PDHRA completion, controlled setting of PDHA/PDHRA completion, type of media (e.g., pencil/paper vs. electronic)

used to disseminate PDHA/PDHRA, or similarity in terms of medical personnel administering PDHA/PDHRA.

By designing an experiment with one or more of the above mentioned controls in place, it would be feasible to conduct accurate test-retest trials and inter-item reliability tests on both the PDHA and PDHRA while simultaneously reducing the amount of variance seen in prior field studies. Since it is mandatory for deployed service members to complete both the PDHA and PDHRA following their deployment, there exists a large potential available sample. A controlled, experimental approach could provide useful reliability and validity information on both of these instruments that are widely used by the U.S. Department of Defense. Increasing the reliability and validity of both the PDHA and PDHRA would allow for medical providers to better accurately predict and, therefore, better provide treatment for physical and mental health related issues following military deployments.

Another possibility of future research would be to reassess the impact of pre-deployment mental health care on post-deployment depression and post traumatic stress disorder using a more robust sample. In other words, rather than having merely 2% of a sample seeking pre-deployment mental health care, it would be better if we had a sample in which 10-15% of the sample had sought pre-deployment mental health care. A more robustly powered regression analysis would make it possible to determine whether lack of significant difference with pre-deployment mental health care was a main effect or an artifact of under-representation of pre-deployment mental health seeking personnel in our sample.

One final potential future research study that would be a natural continuation of this current research would be an expansion of initial findings showing that early depression and traumatic stress symptoms place Navy personnel at higher risk for depression and post traumatic stress disorder 3 to 6 months following deployment. Researchers using civilian populations have shown that early post-trauma depressive symptoms have an impact on the severity of post traumatic stress symptoms 4 to 6 months post-trauma (i.e., Breslau et al., 1991; Shalev et al., 1998). Specifically, these researchers found that individuals who showed early signs of depression around 1 month post-trauma also showed increased post traumatic stress symptoms 4 months post-trauma than individuals who did not show early post-trauma depressive symptoms. The findings from this current study clearly show a positive relationship between early symptoms of depression and later risk for post traumatic stress disorder. In order to further expand on this research, a study could be designed to compare service members who show risk for depression immediately post-deployment with those service members who do not shown risk for depression immediately post-deployment and see which group shows more elevated traumatic stress symptoms 3 to 6 months following deployment. If we could replicate some of the findings shown in the civilian research, then we could better establish early post-deployment depressive symptoms as risk factors for development of post traumatic stress disorder 3 to 6 months post-deployment.

### *Summary*

This study was designed to address gaps in the literature concerning the impact of deployment-related risk factors on post-deployment mental health outcomes of U.S. Navy personnel. Specifically, these risk factors included: combat exposure, prior deployments, component type, immediate post-deployment mental health symptoms, and pre-deployment mental health care. Using data previously gathered from Navy personnel's completion of Pre-Deployment Health Assessment (DD2795), Post-Deployment Health Assessment (DD2796), and Post-Deployment Health Reassessment (DD2900), the impact of these risk factors was measured longitudinally from pre-deployment through 3 to 6 months post-deployment.

Findings showed that Navy personnel with exposure to combat were three times more likely to be at risk for post traumatic stress disorder 3 to 6 months post-deployment. Navy personnel with combat exposure did not appear to be at increased risk for depression 3 to 6 months after their deployment, but this relationship was fully mediated by immediate symptoms of depression. When mediating effects of immediate symptoms were accounted for, a significant relationship between combat exposure and risk for depression 3 to 6 month post-deployment emerged. Specifically, it was shown that Navy personnel with exposure to combat were nearly twice as likely to be at increased risk for depression 3 to 6 months post-deployment. Next, it was shown that prior deployment experience did not appear to affect Navy personnel's risk for depression or post traumatic stress disorder 3 to 6 months post-deployment.

Third, this study showed that Reserve component personnel were twice as likely than their Active Duty counterparts to be at risk for depression and 3.5 times more likely to be at risk for post traumatic stress disorders 3 to 6 months post-deployment. Fourth, findings indicated that Navy personnel who showed depressive symptoms immediately post-deployment were seven times as likely to be at risk for depression and twice as likely to be at risk for post traumatic stress disorder 3 to 6 months after their deployment. Similarly, Navy personnel who showed traumatic stress symptoms immediately post-deployment were three times as likely to be at risk for depression and nearly seven times as likely to be at risk for post traumatic stress disorder 3 to 6 months post-deployment. Finally, there was an unpredicted relationship between Navy rank and risk for PTSD 3 to 6 months post-deployment. Specifically, Navy officers showed significantly less risk for PTSD 3 to 6 months post-deployment compared to Navy enlisted personnel. Navy personnel's rank did not appear to be related to risk for depression 3 to 6 months after their deployment.

In our full deployment analyses, it was found that seeking mental health care prior to deployment was not related to increased risk for depression or post traumatic stress disorder 3 to 6 months following deployment, but this relationship was fully mediated by immediate symptoms of depression. When mediating effects of immediate symptoms were accounted for, significant relationships between pre-deployment mental health care and risk for depression 3 to 6 month post-deployment as well as risk for PTSD 3 to 6 months post-deployment emerged. Specifically, it was shown that Navy personnel with who

sought mental health care within 12 months pre-deployment were four times as likely to be at increased risk for depression and four times as likely to be at increased risk for PTSD at 3 to 6 months post-deployment. Overall the findings of this dissertation research have aided in the expansion of our knowledge of the effects of combat and deployment on mental health in both active duty and reserve U.S. Navy personnel. Furthermore, this research has shown several potential applications for U.S. military in areas of clinical treatment, clinical research, and program development.



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Table 1

*Comparison of Frequency Distributions of Demographic, Predictor, and Outcome Variables*

DEMOGRAPHIC	Post-Deployment Only (n = 365)	Full Deployment (n = 687)	Pearson Chi Square
Gender			
Male	325 (89%)	587 (85%)	ns
Female	40 (11%)	100 (15%)	
Marital Status			
Married	226 (62%)	441 (64%)	ns
Not Married	139 (38%)	246 (36%)	
Age			
18-24	98 (26%)	134 (19%)	ns
25-29	70 (19%)	145 (21%)	
30-39	126 (36%)	260 (38%)	
≥ 40	71 (19%)	149 (22%)	
Rank			
Enlisted	299 (82%)	557 (81%)	ns
Officer	66 (18%)	130 (19%)	
Deployment Location			
OIF	298 (82%)	502 (73%)	p < 0.01
OEF	67 (18%)	185 (27%)	
PREDICTOR			
Pre-Deployment MH Care			
Yes	N/A	14 (2%)	n/a
No	N/A	673 (98%)	
Combat Exposure			
Yes	141 (39%)	262 (38%)	ns
No	224 (61%)	425 (62%)	
Immediate MDD Risk			
At Risk	34 (9%)	57 (8%)	ns
Not At Risk	331 (91%)	630 (92%)	
Immediate PTSD Risk			
At Risk	21 (6%)	37 (5.5%)	ns
Not At Risk	344 (94%)	650 (94.5%)	
Component Type			
Active Duty	272 (75%)	470 (68%)	p < 0.05
Reserve	93 (25%)	217 (32%)	
Deployment History			
No Prior Deployment	245 (67%)	418 (61%)	p < 0.05
Prior Deployment	120 (33%)	269 (39%)	
OUTCOME			
MDD Risk 3-6 Months			
At Risk	22 (6%)	44 (6%)	ns
Not At Risk	343 (94%)	643 (94%)	
PTSD Risk 3-6 Months			
At Risk	30 (8%)	67 (10%)	ns
Not At Risk	335 (92%)	620 (90%)	

Table 2.  
*Summary of Study Hypotheses*

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**H1:** U.S. Navy personnel's exposure to combat will increase their risk for depression and/or post traumatic stress disorder 3 to 6 months post-deployment

**H2:** U.S. Navy personnel with one or more deployments prior to current deployment will show decreased risk for depression and/or post traumatic stress disorder 3 to 6 months post-deployment compared to personnel on their returning from their initial deployment

**H3:** U.S. Navy Reserve personnel will show increased risk for depression and/or post traumatic stress disorder than their Active Duty counterparts 3 to 6 months post-deployment

**H4:** U.S. Navy personnel's immediate post-deployment risk for depression and/or post traumatic stress disorder will be related to those personnel's risk for depression and/or post traumatic stress disorder 3 to 6 months post-deployment

**H5:** U.S. Navy personnel who sought mental health care prior to current deployment will be more likely to be at risk for depression and/or post traumatic stress disorder than non-seekers 3 to 6 months post-deployment.

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Table 3

Adjusted Odds for Deployment Risk Factors Associated With Mental Health Risk among U.S. Navy Personnel 3-6 Months Post-Deployment

<b>Post-Deployment Data Set (<i>n</i> = 1,052)</b>		
<b>Risk Factors</b>	<b>Risk for Depression (3-6 months post) <i>Odds Ratio (95% CI)</i></b>	<b>Risk for PTSD (3-6 months post) <i>Odds Ratio (95% CI)</i></b>
Combat Exposure		
. Yes vs. No	1.15 (0.64-2.10)	3.13 (1.92-5.13) <sup>***</sup>
Prior Deployments		
. None vs. One or More	1.11 (0.63-1.94)	1.04 (0.64-1.72)
Component Type		
. Reserve vs. Active Duty	2.05 (1.15-3.65) <sup>***</sup>	3.50 (2.12-5.78) <sup>***</sup>
Immediate Risk for MDD		
. At Risk vs. Not At Risk	6.94 (3.75-12.84) <sup>***</sup>	1.98 (1.05-3.75) <sup>*</sup>
Immediate Risk for PTSD		
. At Risk vs. Not At Risk	3.21 (1.45-7.13) <sup>***</sup>	6.68 (3.40-13.13) <sup>***</sup>
Rank		
. Enlisted vs. Officer	0.43 (0.17-1.13)	0.40 (0.18-0.87) <sup>*</sup>

<sup>\*</sup>  $p < 0.05$ , <sup>\*\*</sup>  $p < 0.01$ , <sup>\*\*\*</sup>  $p < 0.001$

The results stated in this table are adjusted for all variables in the table

Table 4

Adjusted Odds for Deployment Risk Factors Associated With Mental Health Risk among U.S. Navy Personnel 3-6 Months Post-Deployment

<b>Full Deployment Data Set (n = 687)</b>		
<b>Risk Factors</b>	<b>Risk for Depression (3-6 months post)</b> <i>Odds Ratio (95% CI)</i>	<b>Risk for PTSD (3-6 months post)</b> <i>Odds Ratio (95% CI)</i>
Pre-Deployment MH Care Yes vs. No	2.48 (0.59-10.96)	3.15 (0.82-12.18)
Combat Exposure Yes vs. No	0.99 (0.47-2.06)	2.57 (1.45-4.57) <sup>***</sup>
Prior Deployments None vs. One or More	1.17 (0.59-2.35)	0.92 (0.51-1.66)
Component Type Reserve vs. Active Duty	2.70 (1.32-5.50) <sup>**</sup>	3.81 (2.11-6.85) <sup>***</sup>
Immediate Risk for MDD At Risk vs. Not At Risk	7.81 (3.71-16.46) <sup>***</sup>	2.02 (0.94-4.33)
Immediate Risk for PTSD At Risk vs. Not At Risk	5.41 (2.08-14.07) <sup>***</sup>	6.37 (2.78-14.60) <sup>***</sup>

\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001

The results stated in this table are adjusted for all variables in the table

Table 5  
Unadjusted Odds for Risk Factors Related to MDD/PTSD in U.S. Navy Personnel 3 to 6 Months Post-Deployment  
Full Deployment Data Set (n = 687)

Predictor Variable		Major Depressive Disorder		Post Traumatic Stress Disorder	
		Number (%)	Unadjusted OR(95% CI)	Number (%)	Unadjusted OR(95% CI)
Combat exposure	Yes	21/262 (8.0%)	1.52 (0.83-2.81)	41/262 (15.6%)	2.85 (1.70-4.78) <sup>***</sup>
	No	23/425 (5.4%)	1.0	26/425 (6.1%)	1.0
Prior deployments	≥ 1	19/269 (7.1%)	1.20 (0.64-2.22)	23/269 (8.6%)	0.80 (0.47-1.34)
	None	25/418 (6.0%)	1.0	44/418 (10.5%)	1.0
Component type	Reserve	21/217 (9.7%)	2.08 (1.13-3.85) <sup>*</sup>	35/217 (16.1%)	2.63 (1.58-4.38) <sup>***</sup>
	Active	23/470 (4.9%)	1.0	32/470 (6.8%)	1.0
Immediate depressive symptoms	Yes	19/57 (33.3%)	12.1 (6.13-23.90) <sup>***</sup>	15/57 (26.3%)	9.27 (4.27-20.11) <sup>***</sup>
	No	25/630 (4.0%)	1.0	52/630 (8.3%)	1.0
Immediate traumatic stress symptoms	Yes	12/37 (32.4%)	3.97 (2.06-7.63) <sup>***</sup>	16/37 (43.2%)	8.94 (4.40-18.21) <sup>***</sup>
	No	32/650 (4.9%)	1.0	51/650 (7.8%)	1.0
Pre-deployment MH care	Yes	3/14 (21.4%)	4.20 (1.13-15.66) <sup>*</sup>	4/14 (28.6%)	3.87 (1.18-12.71) <sup>*</sup>
	No	41/673 (6.1%)	1.0	63/673 (9.4%)	1.0

<sup>\*</sup> p < 0.05, <sup>\*\*</sup> p < 0.01, <sup>\*\*\*</sup> p < 0.001



Table 6  
Unadjusted Odds for Risk Factors Related to MDD/PTSD in U.S. Navy Personnel 3 to 6 Months Post-Deployment  
Post Deployment Data Set (n = 1,052)

Predictor Variable		Major Depressive Disorder		Post Traumatic Stress Disorder	
		Number (%)	Unadjusted OR(95% CI)	Number (%)	Unadjusted OR(95% CI)
Combat exposure	Yes	33/403 (8.2%)	1.67 (1.01-2.74)*	63/403 (15.6%)	3.35 (2.16-5.20)***
	No	33/649 (5.1%)	1.0	34/649 (5.2%)	1.0
Prior deployments	≥ 1	26/389 (6.7%)	1.12 (0.67-1.86)	34/389 (8.7%)	0.91 (0.60-1.41)
	None	40/663 (6.0%)	1.0	63/663 (9.5%)	1.0
Component type	Reserve	27/310 (8.7%)	1.72 (1.03-2.86)*	45/310 (14.5%)	2.25 (1.48-3.44)***
	Active	39/742 (5.3%)	1.0	52/742 (7%)	1.0
Immediate depressive symptoms	Yes	27/91 (29.7%)	9.97 (5.74-17.33)***	24/91 (26.4%)	4.36 (2.60-7.35)***
	No	39/961 (4.1%)	1.0	73/961 (7.6%)	1.0
Immediate traumatic stress symptoms	Yes	16/58 (27.6%)	7.20 (3.80-13.70)***	26/58 (44.8%)	10.60 (6.00-18.70)***
	No	50/994 (5%)	1.0	71/994 (7.1%)	1.0
Rank	Enlisted	61/857 (7.1%)	0.34 (0.14-0.87)*	89/857 (10.4%)	0.37 (0.18-0.77)**
	Officer	5/195 (2.6%)	1.0	8/195 (4.1%)	1.0

\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001